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Weeds Of Alberta - Their Identification  
and Control.



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PROVINCE OF ALBERTA

DEPARTMENT OF AGRICULTURE

Field Crops Branch

# WEEDS OF ALBERTA

THEIR IDENTIFICATION AND CONTROL

Published by direction of the  
HON. D. B. MacMILLAN, Minister of Agriculture



EDMONTON:

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**PROVINCE OF ALBERTA**

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## PREFACE

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Owing to the exhaustion of the bulletin, "*Alberta's Weed Problem, 1937*," and the continued demand for this comprehensive type of publication dealing with weeds, it has been decided to issue a new edition at this time in spite of the fact that, due to pressure of other work, it has been impossible to bring its contents completely up-to-date.

However, the introduction and general remarks dealing with weed control, which are to be found in the first few pages of the bulletin, have been entirely rewritten. The same can be said of the treatment given such serious weeds as hoary cress, couch grass, wild oats, etc. Much new material will be found, therefore, which should prove of value to the school teacher, student and farmer alike.

Two weeds, namely, night-flowering catchfly and hemp nettle have been added to the list of weeds illustrated and described herein.

O. S. LONGMAN,  
*Field Crops Commissioner.*



## Introduction

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**A**FTER only half a century of agricultural development in Alberta, noxious weed infestations present one of our greatest farm problems. The expense incurred in weed control represents the largest part of the cost required in producing crops. Whether emphasis is placed upon grain growing, live stock production or a combination of the two, this statement holds true.

Weeds cause direct and indirect losses to the farmer. Firstly, infestations require the adoption of control measures which directly increase the cost of production. Secondly, indirect losses are caused by reduction in crop yields. There is no escape from these losses once land becomes weed infested. Any attempt to save on the cost of cultivating infested land, will result in a greater than proportional loss through a reduction in crop yield.

Accurate estimates of the losses due to weeds cannot be computed but some indication of their relative importance can be given. It is calculated that weeds cost farmers in the United States three billions dollars annually. This exceeds the combined losses due to insects, predatory animals and the diseases of both plants and animals. After fifteen years of experimentation in the south-central portion of Western Canada where drought, soil drifting and insect pests cause heavy losses, it was concluded that weeds were the main factor in reducing crop yields. In the more humid parts of the prairies it is "conservatively estimated" that crop losses due to weeds amount to 25 per cent. The cost of control measures must be added to the above calculations.

One further point is worth noting. The cost of weeds is greatest where an insufficient outlay is made to control them. Time and effort spent to prevent weeds from spreading, or control measures promptly undertaken, will pay big dividends. The greatest losses through weeds are the result of delayed action. In planning the farm production programme, weed control should be given major consideration.



## The Spread of Weeds

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THE majority of farm weeds now found in Alberta are introductions, mostly from Europe. Most of the native plants which are classed as weeds, are a group poisonous to live stock that inhabit our natural grasslands. With these, however, this bulletin is not concerned. Only a few plants native to Alberta persist after the land is cultivated for a few years.

How is it that weeds, these enemies of agriculture, were allowed entry to this continent? The life of the farmer would have been happier and his economic well-being improved without them. A simple answer cannot be given to this question.

At the outset, it was necessary for North America to introduce from Europe most of the economic crops upon which agriculture now depends. With them weed seeds were introduced. Many settlers carelessly brought with them, plants which were not considered weeds at home but which proved obnoxious in the new environment. Even today Europe specializes in the production of certain seeds which become general seeds of commerce and are imported to this Continent. When the most careful inspection of seed is practised there is danger of adding to the already long list of weed seeds imported.

On this side of the Atlantic, soil, climatic conditions and a type of husbandry that facilitated rather than discouraged the reproduction of many foreign plant invaders resulted in a rapid spread of the weeds brought in. Early settlers gave little or no attention to the spread of weeds and the attitude in this respect is not yet above criticism. New plants which might be readily pulled are allowed to produce and disseminate their seeds. Sowing grain containing weed seeds is a common practice. The careless movement and use of infested live stock feed is also common. Animals do not masticate unground screenings thoroughly, hence, all such material should be finely ground before feeding.

Weed seeds may be carried many miles from where they are produced, on implements, packing cases and railway rolling stock.

Natural agencies complete the work of weed dissemination. The wind is perhaps the chief of these. The seeds of sow thistle, Canada thistle and Russian knapweed are attached to tufts of silky hairs. The wind may carry these parachute-like vehicles with the seed attached for many miles. Tumble weeds are sometimes moved great distances by the wind and, due



to the fact that their seeds shatter with difficulty, they may be deposited many miles from where the weeds were produced. Weed seeds are frequently moved from farm to farm in drifted soil.

Water is a natural seed distributing agency. Streams, irrigation ditches and canals carry seeds from farm to farm and from district to district. Soil and the weed seeds it contains are frequently washed from the higher benches of land to the lower levels. The careless farmer whose cultivated fields are situated on high land, is an exasperation to good farmers whose fields receive the "wash" from above.

In spite of the all-pervading nature of the agencies which spread weeds, the adoption of measures to control further spread is still important. Purchase and sow only graded seed of good quality, especially of the grasses and clovers. Clean the grain fed to horses used in the cultivation of the land. Handle screenings with care and crush thoroughly unless stock are fed in an enclosure. Pile barnyard manure and allow it to rot before spreading. Soil erosion may be controlled by care in the selection and use of tillage implements together with a judicious choice of crops in rotation.



## Classification of Weeds

ONE definition of a weed is "a plant growing out of place." Weeds possess in common, a variety of characteristics which enable the plants to persist in spite of all efforts to eradicate them.

Weeds may be classified in several ways, but the most practical classification, from the standpoint of control or eradication, is according to the length of time they live.

(1) *Annuals* germinate from seed, grow, blossom, produce seed and die in one season. Annuals usually produce large quantities of seed. The seed of many species will retain their viability in the soil for many years, if not placed at a depth suitable for germination. The reason that annual weeds are difficult to control is explained by the ability of their seed to live in the soil and to germinate at most unpredictable times. Their fibrous root systems are non-vegetative, that is, do not give rise to new growth.

Some examples of annuals are wild oats, wild mustard, Russian thistle and lamb's quarters.

(2) *Winter Annuals* germinate from seed in the fall of the year, live through the winter in a rosette stage, continue their development in the spring and mature seed by mid-summer or fall. Most winter annuals are also annuals. The following are examples: stinkweed, ball mustard, tumbling mustard, blue bur, shepherd's purse and false flax.

(3) *Biennials* are weeds which produce leaves and roots the first year, and flowers and seed the second year, after which they die. They are usually recognized by a non-vegetative, generally fleshy, tap root. Gray and green tansy mustard and burdock are examples of biennials.

(4) *Perennials* grow continuously from year to year. Most perennial weeds propagate by underground root stocks or rhizomes as well as by seed. The "running" parts of the root system are usually associated with a tap root which penetrates deeply into the soil. This extensive root system acts as a storehouse for plant food which permits the formation of new growth even after repeated destruction of the parts above ground.

Examples of very deeply rooted perennials are field bindweed, leafy spurge, Russian knapweed, hoary cress and Canada thistle. Such weeds as couch grass and Johnson grass are characterized by a mass of shallow underground root stocks and feeder roots.



## General Methods of Weed Control

A wide range of soil types and climatic conditions are to be found in Alberta. Owing to this, weeds that are very troublesome in one part of the Province may give little or no trouble in another and vice versa. Along the foothills and in the central portion of the Province, where precipitation is fairly good and the growing season is short, the control of wild oats is difficult; while on the lighter soils in the dry area to the south and east tumbling mustard and Russian thistle are troublesome. Altogether a condition may be found in Alberta suitable to every type of weed which is known to thrive in the temperate zone.

Moreover, the Alberta climate is extremely variable. Between 1883 and 1932 the annual precipitation by crop years at Edmonton varied from 7.37 to 29.81 inches; at Calgary from 7.54 to 33.91 inches; and at Medicine Hat from 5.43 to 28.52 inches. Variations of from 62 to 189 per cent. of the average occurred in the Province during that period. A wet period in the summer may prohibit the cultivation of summerfallows and render useless much previous work done toward the eradication of perennial weeds. On the other hand, a dry season will make it more difficult to reduce annual weeds by the green fallow method. Seed time and harvest vary from year to year and are beyond the control of the farmer.

The type of farming followed determines to a large degree, the general methods of weed control it is best to adopt. In a broad sense a soil and climatic region, of which there are several in Alberta is characterized by a definite general type of farming. But, and this is particularly true where alternative types of farming are possible, there is a vast difference between farmers and systems of farming in the same district.

Soil drifting, insect pests, etc., may bring about a situation which renders it impossible, or at least inadvisable, to adopt the most effective weed control measures. The farmer who attempted to deal with each problem separately would not stay in business long. In other words, he is forced to plan his production programme, including his tillage methods, in relation to a group of problems, two or more of which may require diametrically opposite methods of treatment.

Thus, the nature of agriculture and the variables to which farming is subject in Alberta, precludes the possibility of formulating rule-of-thumb methods for weed control. The general methods discussed in this bulletin, therefore, must be varied to meet the particular conditions under which they are applied.

### THE CONTROL OF ANNUAL WEEDS

The production of cereal crops forms a major part of agriculture in Alberta. Straight grain growing is conducive to the multiplication of annual weeds and it is this class of weed which has caused the greatest losses by reducing crop yields in the Province. Most weeds mature their seeds in grain crops and many fall to the ground before and during harvesting operations. To such an extent does this occur that, except in



years favourable to the production of heavy cereal crops, the weed seed population of the soil increases in the crop year. Therefore, if annual weeds are to be destroyed, cultivation designed to promote the germination of weed seeds in the period between crops, in the fall and spring, and in the summerfallow year must be practised.

Annual weeds persist largely because of the power of delayed germination possessed by their seeds. Most of them retain their viability for many years when buried in the soil, especially under dry conditions. Moreover, when brought to the surface the seeds still viable may show a very indefinite and variable tendency to germinate. Some may grow at once, others in six months and so on. The ability of some seeds to germinate improves for many years when buried in the soil. In one test, the seed of evening primrose showed no immediate response after being buried for one year; grew 48 per cent. after three years; refused to germinate after six years; and grew 74 per cent. after ten years. Dr. Beal buried twenty species of seeds in 1880 and in 1930, five of them germinated. After fifty years, curled dock germinated 52 per cent., evening primrose 38 per cent., and black mustard 8 per cent. In another test, bitter dock grew 59 per cent. after 21 years; and Canada thistle, lamb's quarter and stinkweed still survived.

Variation in the power of weed seeds of the same species to germinate is all to the advantage of weeds in their struggle for existence. Should all the seeds grow at once and conditions unfavourable to the species occur, that particular species might cease to exist. The spreading out of the germination process, increases the possibility of successful propagation.

These facts have a bearing on the practices that should be adopted to control annual weeds. By burying the seeds in the ground, their natural defense for survival is strengthened. They will germinate quicker and more uniformly if kept near the surface of the soil. Cultivate shallow for the control of annual weeds.

### *GREEN SUMMERFALLOW—*

The object of green summerfallow is to reduce the population of annual weed seeds in the soil. Too often the desired result is not obtained due to improper or untimely cultivation. A series of deep cultivations begun in June and ended in August may serve merely to bury the seeds lying on the top of the ground and dry out the soil to such an extent that no germination occurs. Most small seeds germinate best when covered to a depth of from  $\frac{1}{2}$  to 1 inch. Therefore, the first tillage operations should be shallow to stimulate the germination of weeds on the surface. Subsequent cultivations may be deeper. When deep plowing is resorted to without previous surface cultivation, many seeds are buried and thereby assisted to survive the fallow.

The fallow period begins when one crop is removed and continues until another is sown. Utilize this period to the fullest extent for the germination of seeds and the destruction of weed seedlings. Lightly disc the land after the binder or as soon after harvest as possible. This will stimulate fall and early spring germination. Throughout the following year, cultivations should not be too frequent for the loosening and drying of the soil will slow up germination. Allow sufficient time between operations to promote maximum germination without allowing the weeds to grow so large as to unduly rob the soil of moisture or become hard to destroy. Weeds are most easily destroyed on a warm day when the soil surface is



reasonably dry. After each tillage operation, the land should be harrowed to complete the destruction of all weeds and then packed. The latter is important. It conserves moisture and firms the soil around the small weed seeds which it is desired to "grow out."

The reduction of weed seeds in the soil during a fallow year, depends to a large extent upon the season. Good germination is secured without difficulty in a wet year, but in a dry season the reverse is true. However, it may be said with a good deal of truth, that the test of a farmer is his ability to utilize the best in a wet season when the job is to eradicate perennial weeds and to germinate annual weed seeds on his summerfallow in a dry year. The latter can be done with a fair degree of success by careful tillage with the view to conserving available moisture and keeping the surface of the soil well firmed.

### *FALL CULTIVATION—*

Regardless of the use to which the land is to be put the following year, fall cultivation is advantageous. Even weeds that are described as "surface germinators" will grow quicker and more uniformly if covered at a depth of  $\frac{1}{2}$  inch. Disc lightly immediately after the binder or as soon after threshing as possible. If moisture is present some germination will occur in the fall; if not, the seeds are in a position to germinate early in the spring.

### *SPRING CULTIVATION—*

Spring cultivation for the purpose of germinating weeds to be destroyed before seeding, cannot be utilized in Alberta to the extent it is elsewhere. In the south, early seeding is necessary if the crop is to take full advantage of available spring moisture. In this area, too many cultivations before seeding will dry out the soil with serious consequences in a dry year. In the north, the length of the growing season is a limiting factor in crop production. Delay in seeding will increase the danger of frost damage in the fall. Weed control by tillage before seeding where a short season prevails, therefore, can be resorted to only on land intended for the production of greenfeed or such a crop as early barley.

The foregoing should not be taken to indicate that cultivation before seeding is not advised. Surface cultivation to destroy all weed growth immediately before seeding is always recommended and should form a standard cultural practice.

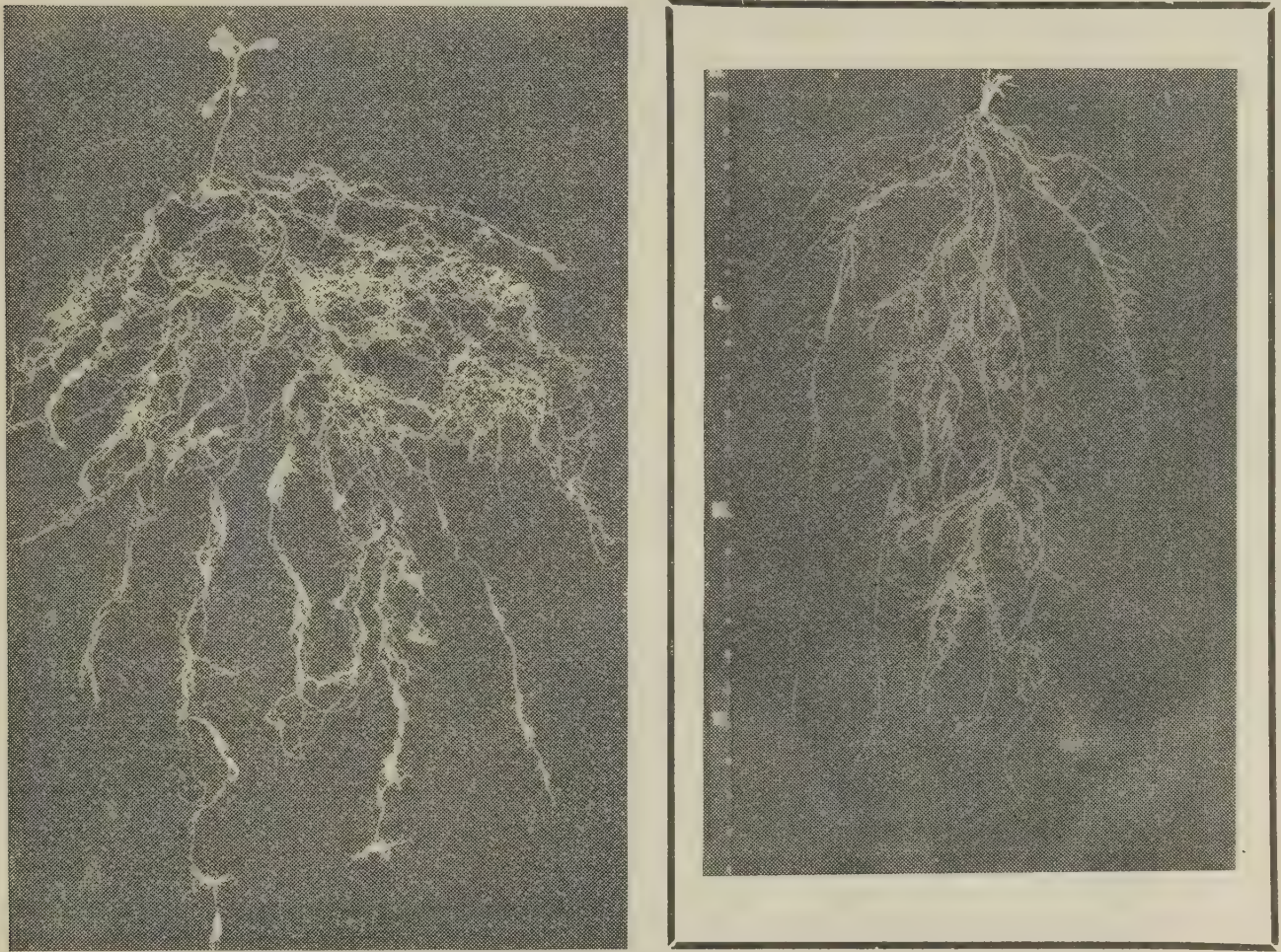
### *PLANT COMPETITION—*

Cereals germinate quicker, more uniformly and at lower temperatures than the common weed seeds. Moreover, in the the early stages of growth the root systems of the cereals as well as the parts above the ground, develop more rapidly than weeds. The critical period in the competition staged by these two classes of plants, is during the first month of growth. In that period cereals have certain distinct advantages over common weeds which can be utilized to effectively control the latter.

Thus annual weeds might be well and efficiently controlled by seeding cereal crops in a well prepared seed bed, early, evenly and at a shallow depth, at heavier than normal rates and with a phosphate fertilizer. The use of good sound seed which has been treated against smut with chemical dust rather than formalin, will assist in producing quick germination.



Weeds are slow to germinate and when the crop is seeded under ideal conditions for growth, they are dwarfed at the outset, may succumb to competition in the seedling stage or produce spindly plants that do not interfere seriously with the crop. Moreover, under the conditions outlined, the production of weed seeds in the crop is materially reduced.



A comparison of the competition between a wild mustard seedling (left) and garnet wheat (right) twenty-one days after emergence. (After Pavlychenko, T.K.)

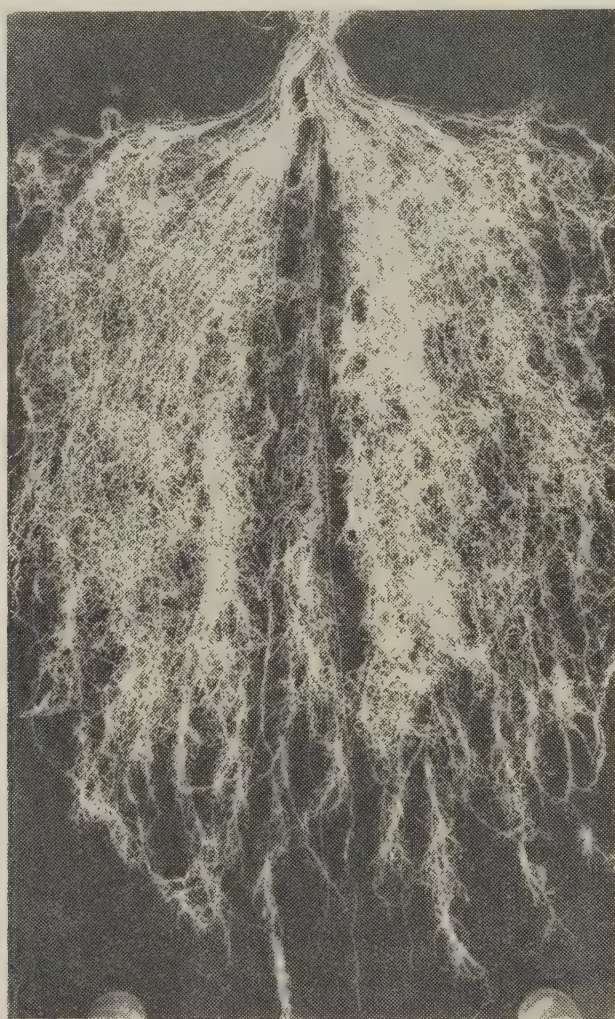
It has long been known that different grain crops do not compare equally in ability to control or smother weeds. Recent experimental work has confirmed this belief. The results rate the ability of the common cereals to control weeds as follows: barley, spring rye, wheat and oats. Barley, it was found, quickly develops an extensive root system which spreads horizontally in the soil rapidly filling the spaces between the rows. This action tends to reduce the germination of weed seeds and causes many small seedlings to die. A comparison of the root systems of the cereals would indicate that the efficiency of each in weed control is in direct proportion to the spread of their root system. Thus, as a weed control crop, oats rank at the bottom when compared with other common cereals; and, likewise, its root system shows the least horizontal span.

The production of winter rye and wheat have a place in the control of annual weeds. Annuals that germinate in the fall after the crop is sown will be destroyed by frost. In the spring the growth of the crop is usually rapid enough to crowd out most of the weed seedlings that may appear. The early harvesting of winter grain reduces the amount of weed seeds that mature and allows a longer period for fall cultivation.



The continued growing of cereal crops usually results in a definite rise in the weed seed content of the soil. On the other hand, in a field seeded down to a forage crop a marked decrease in weed seed population is shown for about three years, after which reduction continues, but at a slower rate. Some seeds rot in the soil, the seedlings of many others that germinate do not usually survive the competition of an established forage crop and little if any seed is returned to re-infest the soil.

Crested wheat grass is a perfect annual weed control crop in the drier sections of the province. It takes complete possession of the soil and appears to be capable of establishing a permanent sod in the prairie region. In areas of greater rainfall, crested wheat is not so efficient in weed control nor is it a recommended forage crop. Where rainfall is sufficient, however, any number of pasture and hay crops may be selected. Alfalfa is widely used but as a weed control crop may be improved by seeding with a grass that spreads by creeping root-stocks. A mixture of two-thirds alfalfa and one-third brome will provide an excellent forage crop with ability to subdue weeds. Brome seeded alone will control wild oats, lamb's quarters and stinkweed by the end of the second year, but after five or six years, will become sod bound and weeds appear again. Grasses such as creeping red fescue and Kentucky blue grass are being utilized to an increasing extent for weed control. They combine well in a mixture with alfalfa and would seem worthy of a trial.



The root system of a single plant of trebi barley at maturity. (After Pavlychenko, T. K.)

### THE ERADICATION OF PERENNIAL WEEDS

Most perennial noxious weeds have extensive root systems which serve a three-fold function. First, they provide anchorage and absorb the food requirements of the plant from the soil. Secondly, most perennial roots



are vegetative, that is, they are capable of initiating new growth. Thirdly, the whole root system is a storehouse for plant food. Consideration of the last point is very important when the eradication of a perennial weed is to be attempted.

The roots of perennial weeds differ in composition. Pavlychenko states that:—

“The roots of poverty weed, field bindweed, hoary cress and leafy spurge, possess an extremely thick, corky layer in their bark, abundant food reserves and penetrate to a depth of 12 to 20 feet below the surface. For these reasons they may resist successfully a complete inhibition of their top growth for a period of one season without noticeable loss of vigour. In the second consecutive year of this treatment, they suffer noticeably, but often preserve some of their vitality even after three years.”

The construction of the roots of these weeds, enable them to resist decomposition by rotting while undergoing the process of eradication by cultivation or otherwise. Though not so persistent, the root system of Canada thistle is of similar material. In the case of perennial sow thistle, however, the root bark is thin and weak affording it little protection against decay, and rendering the weed easier to eradicate.

We became accustomed long since to the admonition that absolutely black fallow was essential to the efficient eradication of perennial weeds. We now find that this was a mistake. Weeds may be allowed to grow about a week after emergence without risking the danger of increasing the store of food reserves in the roots. While more frequent cultivations will achieve eradication in a shorter time, the direct cost of tillage will be higher by the black fallow method, and, in addition, the soil may become so finely worked as to drift or wash easily.



The propagating root systems of sow thistle (left) and Canada thistle (right) extend from the tap root at different depths in the soil. This material was dug from the same square foot of soil. (After McRostie, G. P.)



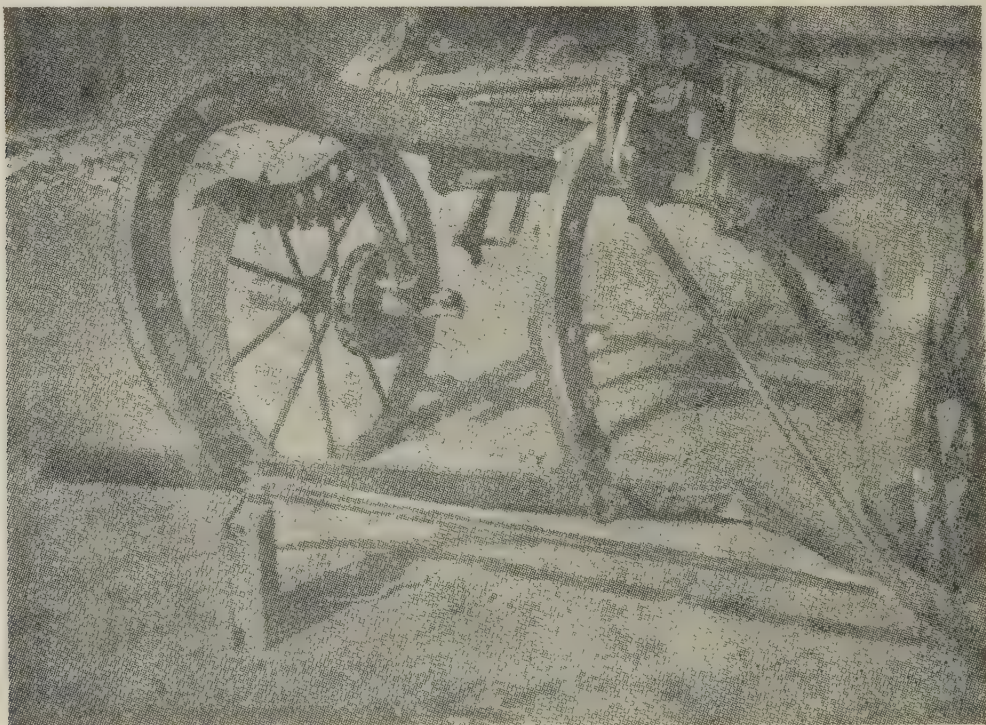


A crop failure in Alberta due to hoary cress. An adjoining field yielded twenty-five bushels per acre.

### *TILLAGE IMPLEMENTS—*

Success in the eradication of perennial weeds, depends largely upon the type and adjustment of the implements used. It is important that only absolutely clean cultivations be tolerated. Every root must be severed at each operation. All cutting edges should be kept sharp and sufficient overlap provided so as to avoid misses in the field.

In many cases, the plow is not essential to good cultivation. Sometimes it is distinctly inadvisable to use the plow. The duckfoot cultivator is a standard implement and, when the shares are kept sharp, will do good work. The rod and cable weeder are good for the control of all kinds of weeds but should be used with caution lest the soil be pulverized too finely,

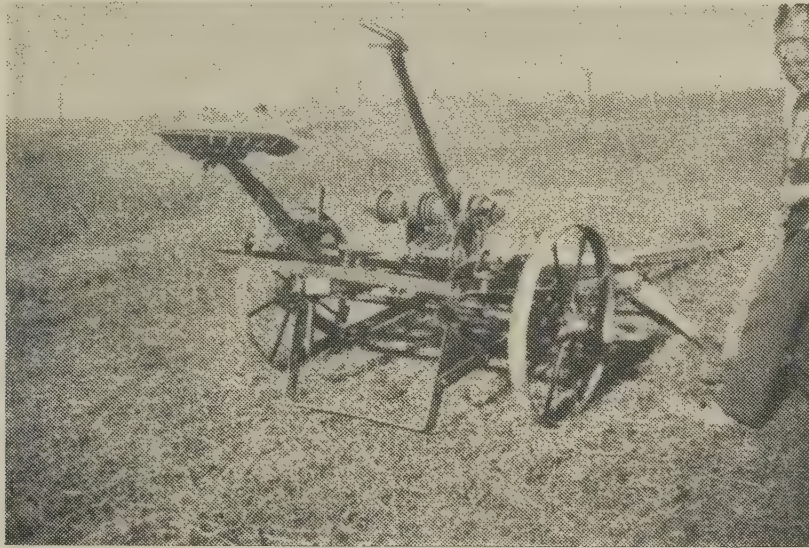


Home-made weeder designed to eradicate perennials. This consists of sloping blade attached to two-bottom gang plow. (Kansas State Board of Agriculture.)



especially by the cable weeder. Also because this type of weeder tends to pack the soil, the use of the duckfoot or plow is occasionally necessary, in order to permit adequate penetration.

In the past few years C. S. Noble of Nobleford, Alberta, has developed a straight-blade weeder which is being used successfully in the southern part of the province. Others are using V-shaped blade equipment. These machines are intended for shallow cultivation. It is claimed that the blade-type cultivator leaves the trash on the surface of the soil, reduces soil drifting and conserves moisture to a high degree. There is no danger



Efficient home-made weeder useful to eradicate small patches of perennials.

of this implement sliding around big weeds in the field. However, the blade will not work where trash has been mixed with the soil and it is possible that only in special cases will it work in conjunction with the plow. It cannot be used in stony ground.

Several successful types of home-made weeders are now in use. Blade-type implements are becoming popular. They can be cheaply constructed in the farm blacksmith shop out of waste material and an old grader blade or a bar of stalk cutter steel as the cutting edge. Any kind of frame with sufficient strength may be used to support the blade. In the south of the Province a home-made cultivator with sweeps that cut 36 to 42 inches has been developed. It is made of discarded engine-plow material. Because of the size of the shovels it has been named "*The Paul Bunyan*." The Paul Bunyan operates satisfactorily under conditions existing in the south and may have a much wider range of application. It is suggested that farmers may put mechanical ingenuity to good use in the development of implements suitable to the soil and conditions of farming that obtains in their respective districts.

### SMOTHER CROPS—

Under ordinary circumstances, a farm badly infested with perennial weeds cannot be cleaned up in one or two years. The average farmer whose land is infested with weeds, must derive his living from the soil he tills while he is getting rid of the pests. In such cases he is advised to undertake eradication on a limited area, to be determined by the capital and equipment available. At the same time, an attempt must be made to profitably utilize the remainder in the production of crops. A combination



of clean cultivation and the production of crops that will most successfully control weed growth should be adopted. Since cultivation is limited to the period between harvest and seeding, it is important that it should be done at a time that it will do the most good. In other words, to be most effective, cultivation must be done at a vulnerable period in the growth of the particular weed which it is desired to control. For example, Canada thistle and couch grass are most seriously disturbed by cultivation in the fall while hoary cress, is set back severely if cultivated in the latter part of May. The latter weed is not likely to produce seed if thoroughly cultivated at this time and the land seeded to a quick-growing crop.

The management of cereal crops for the control of annual weeds has already been dealt with in this bulletin. The general principles of husbandry and the comparative advantage of different cereals are the same in the control of perennial weeds. The date of seeding effects the measure of weed control obtained, and, while some general conclusions have been reached on this point, with respect to the control of particular weeds, seasonal variations in the weather confuse the question and further observation is required.

In the control of perennial weeds, the value of fall rye cannot be overestimated. This crop starts growth early in the spring and shades the ground quickly. It can be harvested early to allow a considerable period for after-harvest cultivation. Where moisture conditions are favourable or if alternated with fallow, several crops of fall rye might gradually effect the eradication of the worst perennial weeds.

Forage crops will control many perennial weeds. Where an adequate amount of precipitation is received, alfalfa is generally recommended as the best control crop. The addition of a grass with creeping root stocks, such as brome, Kentucky blue or creeping red fescue will increase the weed control value of the alfalfa. Moreover, should spots in the alfalfa winter kill, the grass will soon occupy the space left vacant. In areas of low rainfall, crested wheat grass definitely has a place as a weed control crop and should be utilized for this purpose.

Until the forage crop is well established, clip the weeds with a mower to prevent the formation of seed. Undue injury to the seedling forage crop plants is prevented by tipping the bar of the mower high. If the crop is pastured it should be utilized sparingly until well established; or good development should be encouraged by cutting a crop or two of hay before resorting to pasturing. When the crop has reached the stage of production, care should be taken to harvest the hay before weed seeds mature. If this cannot be done the forage crop will lose much of its value as a weed control measure. In any event, care should be taken when feeding hay produced on ground infested with serious perennial weeds. All manure should be well rotted before using.

With the exception of such weeds as Canada thistle, forage crops will not successfully compete with perennial weeds unless the land infested is intensely cultivated for at least one year before seeding. They may be used, however, to complete eradication begun by a period of cultivation. In the eradication of such persistent weeds as Russian knapweed and leafy spurge by this method, it would seem that the weakening of the weed by thorough cultivation is especially important. Moreover, the forage crop should be seeded under conditions and in such a manner as to assure a good stand and rapid growth.





The value of crested wheat grass as a weed control crop, is due to the extensive root system which this crop develops in the soil. (After Pavlychenko, T. K.)

### WEED CONTROL BY COMMERCIAL FERTILIZERS

In Alberta, cold soil conditions frequently retard the growth of crops for a period in the spring. After reaching a height of 2 to 4 inches cereals may develop slowly for a week or ten days. Many weed seeds germinate best at low temperatures and when the condition described above exists, they have an opportunity to develop and compete strongly with the grain.

The seeding of commercial phosphate fertilizer in the drill row, will promote a more vigorous early growth on the part of the seeded crop and improve its position in competition with weeds. The majority of weeds grow between the drill rows and receive little or no benefits from the fertilizer.

It should be emphasized that good preparation of the seed bed has much to do with the effectiveness of fertilizers in controlling weeds. Fertilizer is not a substitute for good farming. Little or no benefits are derived from fertilizer applied on land infested with weeds that have germinated before the crop is seeded. Destroy weeds by cultivation before seeding so that the crop can take full advantage of the fertilizer and develop ahead of weeds that may germinate later.





Wild mustard control by the use of commercial phosphate fertilizer. Left, treated; right, untreated.



Wild oat control in barley by the use of commercial phosphate fertilizer. The strip down the centre is unfertilized.

### THE ERADICATION OF PERENNIAL WEEDS BY BURNING

Investigators in Wyoming recently discovered that perennial weeds can be successfully eradicated by repeated burning. While fundamental research has not been done on the process, it is proven that for best results the flame should be passed rapidly over the tops of the plants, so lightly searing them that they will not wilt until the following day.



The first burn is given when the plant is in the pre-budding stage and the treatment is repeated at from 3 to 5 week intervals until eradication is complete. In the case of hoary cress and Canada thistle an average of 8 or 9 burnings over a two-year period are required. Weeds on dry areas react more quickly to burning than those in moist or wet situations.

A spray pump at 75 to 125 pound pressure (for different types of fuel) may be used. "The burning gun is merely a 12-foot  $\frac{1}{4}$ -inch iron or copper alloy pipe with a spray gun cut off at the operator end and a  $\frac{3}{64}$ -inch Chipman weed disc at the flame end. A loop is placed in the flame end in order to pre-heat the fuel with its own flame before it is ignited.

A wide variation in results is shown even on a given weed species. It has been determined that burning is a better eradicator than chlorate on hoary cress and Canada thistle but that the chlorate method is cheaper in the case of field bindweed and Russian knapweed. The greatest advantage of the burning method is that when no growth occurs for a year after treatment the roots are definitely dead. In the case of chlorate treatment, experience would indicate that one can never be sure that the weeds are completely eradicated. This is especially true of hoary cress.

The eradication of weeds by burning would seem to have a place on roads, along fence lines and ditches and in waste places. While the best technique in the application of this method is not yet developed, there is sufficient assurance of its possibilities to warrant that the method be given a trial in Alberta.

## WEED CONTROL BY CHEMICALS

During recent years considerable attention has been given to the control of weeds by chemicals. In the eradication of perennials, the cost of chemicals prohibits their use on an acreage basis. However, the treatment of weeds in small patches, in inaccessible places, along fence rows and on ditch banks may be justified. In Alberta, little use has been made of chemicals to destroy annual weeds but from the enquiries received there would seem to be a growing interest in this method of control.

### *PERENNIALS—*

When chemicals are used for the control of perennial weeds, complete eradication should be the objective. If the weeds are not entirely destroyed after the first treatment follow-up treatments should be given until no regrowth occurs.

Sodium chlorate is the chemical most widely used as a perennial weed killer. Chlorate may be applied either as a spray or in the dry form. In most cases, the dry method of making application has proved to be as effective as the spray method. The advantages of dry applications are that a full dose can be applied at once, less labour is required, expensive equipment is not necessary and the fire hazard is greatly reduced. However, care must be taken to ensure that the powder is evenly distributed over the infested area. The action of sodium chlorate is directly downward and even discing the surface of the ground after application will effect a "ridgy" result.

When the spray method of application is used, two or three light applications will usually give better results than the same amount of material



applied in one dose. Dissolve one pound of chlorate in a gallon of water or sufficient to secure even distribution of the chemical. It is believed advantageous to spray the ground rather than the plants. Cut the foliage 4 inches above the surface and remove. This practice will save chemical and reduce the fire hazard. Should the foliage not be removed, application in a finely atomized spray under pressure will give best results.

Sodium chlorate is most effective when applied in the late summer and fall. The latter applications are frequently most effective. It may be necessary to keep the weeds from seeding prior to treatment by mowing.

The amount of sodium chlorate to use, varies with the weed to be eradicated, the type of soil and other conditions. Local factors and experience in the use of the chemical are important. From 1 to 1½ pounds per 100 square feet is usually sufficient to eradicate perennial sow thistle. Canada thistle and couch grass require more. Field bindweed and Russian knapweed are relatively easy to destroy by the chlorate method while hoary cress may prove extremely difficult.

When applied in sufficient quantities to destroy perennial weeds, sodium chlorate will render the land unsuitable for crop growth for two years or longer. Moreover, good and consistent results cannot be taken for granted. The chemical acts on the top of the plant and destroys the root system only as deeply as it penetrates the soil. One can never be sure that roots beneath the depth of chlorate penetration will not be preserved and grow when the toxic effect of the chemical has disappeared.

Care should be taken in using chlorate, as when mixed with finely divided organic matter, friction may cause fire. Persons employed in spraying should wear rubber boots and when the job is completed all clothing that has come into contact with the chemical should be washed. The fire hazard may be reduced by substituting Atlacide, a commercial preparation containing sodium chlorate as the killing agent.

The use of carbon disulphide as a herbicide for the eradication of perennial weeds is increasing in the United States. In action it is swift and the surest of any chemical yet tried; but both the cost of the material and expense of applying it are high, totalling about \$2.50 per 100 square feet in Alberta. Moreover, it is not suitable to all conditions. Carbon disulphide is a liquid which gasifies and spreads throughout the soil when "planted." Best results are obtained on good loam soils that are in good tilth and well supplied with moisture. It is effective on irrigated land where the water supply can be controlled. In a dry region, application should be made in the spring before the soil has dried out. Good results cannot be expected on gravelly and gumbo soils because under these circumstances the chemical gas either escapes too readily or does not penetrate.

To apply carbon disulphide, holes are made 8 inches deep in the soil and 18 inches apart each way, the holes staggered in adjoining rows. About 2 ounces of fluid are placed at the bottom of each hole which is then filled and tamped. The labour cost involved is greatly reduced by use of an ejector-type gun recently developed.

Common salt applied at the rate of one pound to the square foot will inhibit plant growth. Its use is limited, however, because it leaves the soil almost indefinitely sterile.





The application of carbon disulphide by means of an ejector gun, greatly reduces the labour involved. The man at left is "tamping" the soil to prevent too rapid escape of the chemical fumes which destroy the root system of the weeds. (After Spence, H. L.)

### ANNUALS—

It has been known for more than forty years that an aqueous spray will almost entirely run off such plants as the cereals, corn, flax, alfalfa, peas and onions. Also that various common annual weeds such as wild mustard, wild radish, prickly lettuce and stinkweed, possess rough or pubescent surfaces which are easily wetted by a spray, and, because of the broad leaves of the weeds, considerable spray comes into contact with and destroys the plants. These facts have led to the use of "selective" chemical sprays for the control of susceptible annual weeds in growing crops.

The selective principle was discovered in 1896 by a Frenchman who worked with dilute sulphuric acid. In 1911, it was introduced as a practical measure of weed control in fields. Since that time other chemicals such as copper sulphate and iron sulphate have been utilized successfully. In 1933 a basic dye material (sodium dinitro-ortho-cresylate) was developed from coal tar, and is sold as a fumicide under the proprietary name of Sinox.

Iron sulphate is less frequently used now than formerly. Copper sulphate is more toxic and has been successfully used in Western Canada. This material is non-corrosive. However, it is more influenced by weather conditions and much more costly than sulphuric acid.

In the last decade, the use of sulphuric acid and Sinox in the control of wild mustard has increased enormously. The cost of application ranges



from about \$2.00 to \$3.50 per acre. Their use, therefore, is so far limited to heavy weed infestations or to areas where intensive land use is practised.

The use of selective sprays in Europe have increased the yield of wheat by 20 per cent., of oats 29 per cent. and of barley by 26 per cent. On badly infested land in California, the yield of wheat was more than doubled, that of flax raised from 4.9 to 21.8 bushels and the yield of oats from 50 to 70 bushels per acre.

Another benefit which will ultimately accrue from the continued use of these materials is the complete eradication of the weeds in question. While there is little definite information on the subject, it is believed that an effective annual programme of cultivation and spraying will practically rid the soil of weeds in from 4 to 6 years. After that, hand pulling should be practised to complete eradication. Where final eradication of the weed treated is the objective, therefore, part of the cost of the spraying each year may be charged to the increase in the value of the land which will result.



Mustard plants at the right stages for treatment with a selective spray. The corresponding sizes of grain plants are shown at the right. (After Westgate, W. A., and Raynor, R. N.)

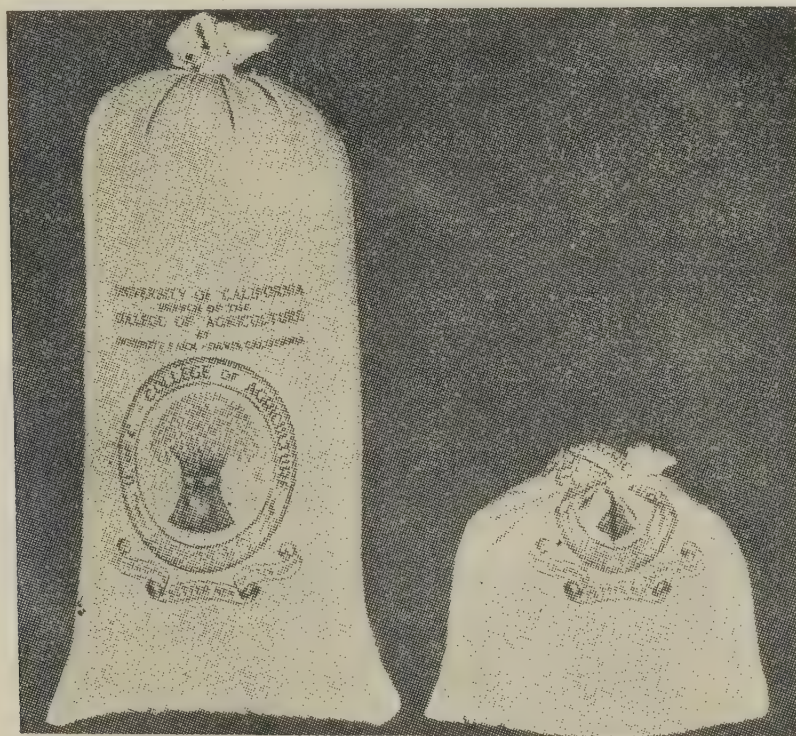
Selective sprays act most effectively on young or weak plants. Plants growing spindly in a heavy crop, are more readily killed than vigorous weeds growing in a light crop. While young plants are easiest to kill, spraying should be delayed until danger of heavy regrowth from seed has passed. In general, the earliest growth should not be more than 6 or 7 inches high when the spray is applied. Not only are the weeds more difficult to kill but the crop is detrimentally effected by later treatments. Young cereals, for example will recover from the effects of the treatment in a week; if 10 to 12 inches high complete recovery may require 3 to 4 weeks.

Though the results are the same, the action of sulphuric acid and Sinox on the plant tissues are fundamentally different. The former "burns" the plant while the action of Sinox might be described as a slow poisoning process that results in the complete rotting of the plant. However, conditions favourable to success are similar for both materials. Sulphuric acid is most effective in an atmosphere favourable to rapid evaporation; low temperatures and dry conditions slow down the action of Sinox.

Sinox is non-corrosive and may be applied with ordinary types of spraying equipment. On the other hand, dilute sulphuric acid corrodes metal



surfaces and, until recently, the problem of spraying equipment was difficult. However, a few years ago, an ejector device was developed by which it is possible to inject concentrated acid into the water discharge line between the pump and the boom. Thus the amount of acid-proof equipment necessary was reduced.



21.8 bus. per acre

4.9 bus. per acre

Showing difference in yield as a result of wild mustard control in flax by selective spray treatment in California. (After Westgate, W. A., and Raynor, R. N.)

Since the introduction of the ejector method of mixing acid and water for spraying, the Durimet acid spray pump has been developed. The manufacturers of this equipment claim it will not corrode even when constantly in contact with dilute sulphuric acid. Moreover, they claim simplicity in operation at lower cost than by the ejector method.



## The Noxious Weeds Act, 1932

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The Noxious Weeds Act and amendments thereto provide that:—

- 1.—(a) Class A noxious weeds means field bindweed, hoary cress, leafy spurge, Russian knapweed, perennial sow thistle, Canada thistle, hemp, and any other weed declared to be a Class A noxious weed by the Lieutenant-Governor-in-Council.
- (b) Class B noxious weeds means blue lettuce, all members of the mustard family, false flax, shepherd's purse, red root, stinkweed, Russian thistle, great ragweed, wild oats, Russian pigweed, blue bur, tumble weed, purple cockle, cockle bur, common barberry, toad flax, black-headed sunflower, corn spurrey, tartary buckwheat, downy brome grass, couch grass, hemp nettle, cow cockle, white cockle, hedge bindweed and bladder campion, and any other weed declared to be a class B noxious weed by the Lieutenant-Governor-in-Council.
- 2.—(a) "Land" means and includes not only all lands owned or occupied or controlled by any person but also means and includes the land up to the centre line of all contiguous roads and road allowances, etc.
- (b) "Occupant" means any person occupying or having the right to occupy or to control any lands.
- (c) "Owner" means not only the registered owner under The Land Titles Act, but extends to and includes every person who has any estate or interest in land or who has any right to be vested with such estate or interest.
- 3.—The Noxious Weeds Act also provides that it shall be the duty of,—
  - (a) Every owner and occupant of land to prevent any noxious weeds growing upon such land, and to comply with all provisions of the Act for the destruction of such weeds.
  - (b) Every irrigation district, drainage district and irrigation company to prevent any noxious weeds growing upon any earthworks, ditches and land occupied by such districts or company as a right-of-way, and to comply with the provisions of the Act for their destruction, provided that the owner or occupant of such land has not entered into a contractual agreement to undertake such duties.
  - (c) Every railway company to prevent any noxious weeds from growing upon any land owned or occupied by it for its railway undertaking, and to comply with the provisions of this Act for their destruction.
  - (d) Every thresher to remove from threshing equipment all noxious weed seeds and destroy same before moving such equipment to any other farm.
  - (e) Every operator of a combine harvester to remove all noxious weed seeds from harvester and destroy same.
  - (f) Every operator of any threshing machine or combine to clean all threshed grain so that it will not contain more than 100 noxious weed seeds to every 1,000 grains.



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- (g) The owner of every threshed crop to destroy all screenings containing noxious weed seeds, or place the same in approved containers. such screenings must be moved in closely woven sacks or approved containers.
  - (h) Every thresher to display at all times in a prominent place on his machine a copy of threshing permit.
  - (i) Any person who operates any vehicle or machine on or adjacent to any road, road allowance, railway, highway, street or lane, to operate same in such a manner than any noxious weed seeds shall not come upon such land.
  - (j) Every person not to deposit or permit to be deposited any weeds or weed seeds on any roads, road allowances, highways, streets or lanes, or in any bodies of water.
  - (k) Every operator of any machinery to remove any noxious weed seeds from same before machinery is brought upon any public highway, street or lane.
  - (l) Every person who moves settlers' effects to remove all noxious weed seeds from same before being moved, and to forward a statutory declaration to this effect to the Field Crops Commissioner.
  - (m) Every person within the Province to obtain consent in writing from the Field Crops Commissioner before taking delivery of any hay or green sheaves from any point without the Province.
  - (n) Grade A or Grade B screenings may not be bought, sold, kept for sale, offered for sale or removed from any grain elevator, mill, warehouse or farm, except in compliance with the provisions of the Act. Grade A screenings bought for feed for live stock must be moved in closely woven sacks to conform to specifications prescribed by the Field Crops Commissioner and fed only within approved feed yards. Grade B screenings shall not be bought, sold or removed by any person without first obtaining a permit covering same, such permit to be in duplicate, and the duplicate forwarded by the seller of the screenings to the Department of Agriculture within thirty days. Every person who has Grade B screenings which are not kept in approved containers must destroy same by burning so as to prevent same being scattered.



## Field Bindweed

(*Convolvulus arvensis*, L.)

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Field bindweed belongs to the morning glory family. It is a trailing or climbing vine originally introduced from Europe. The leaves vary in size and shape, and are usually small (1 to 2 inches long), somewhat arrow-shaped and blunt or rounded at the tip. The flowers are rarely more than 1 inch across, usually pinkish in colour, sometimes white. The seeds are rounded or angular, hardly  $\frac{1}{4}$ -inch long, dark grey and finely roughened. Many seeds are hard and practically impervious to moisture, causing germination to be slow and irregular, thus many seeds can and do remain in the soil for many years before germinating.

The root system of field bindweed is very extensive and may extend to a depth of more than 20 feet. Most of the lateral roots by which the plant propagates are found in the first 4 inches of soil, but may arise at a depth of 1 to 2 feet. In one case, it was observed that the roots of a seedling plant spread 6 feet outward and 5 feet down, in the short period of fourteen weeks.

Field bindweed is widespread in Western United States. It thrives best in the areas that receive a medium amount of rainfall. Under ordinary tillage practises, the summer fallow provides ideal conditions for the spread of this weed by its roots. This is because of plentiful moisture in the fallow and the lack of competition.

This weed was introduced into Alberta with beet, swiss chard and other imported garden seeds. It has appeared in many of the sugar beet fields of Southern Alberta. In 1939 it was found in several gardens in the Calgary district and, in 1940, at Grande Prairie, revealing a condition that might exist in every part of the Province. Everyone should check their garden for field bindweed.

Field bindweed is the most difficult of all weeds known, to eradicate. Usually two full seasons of cultivation are required to do the job and stubborn cases take much longer. The reason for this is the slow depletion of food reserves from the deeper roots under fallow treatment. Therefore, in the eradication of old, deep-rooted patches of bindweed, it would be beneficial if the reserves of food in the roots could be reduced by the smother crop method. Whether this is practical, however, must yet be determined.

The best time to begin cultivations for the eradication of field bindweed is indicated by a sharp drop in root reserves during the winter months and a rapid recovery following spring growth. Cultivations, therefore, should commence within two weeks after growth starts in the spring. Delay on this point, may increase the fallow period required for eradication by as much as a full season.

Generally, it is recommended that the first tillage operation should consist of fairly deep plowing. However, this may be dispensed with where it is deemed not advisable to plow. Subsequent tillage operations should be at a depth of 4 or 5 inches. To insure the uninterrupted depletion of root reserves in the fallowing process, not more than 8 days growth above

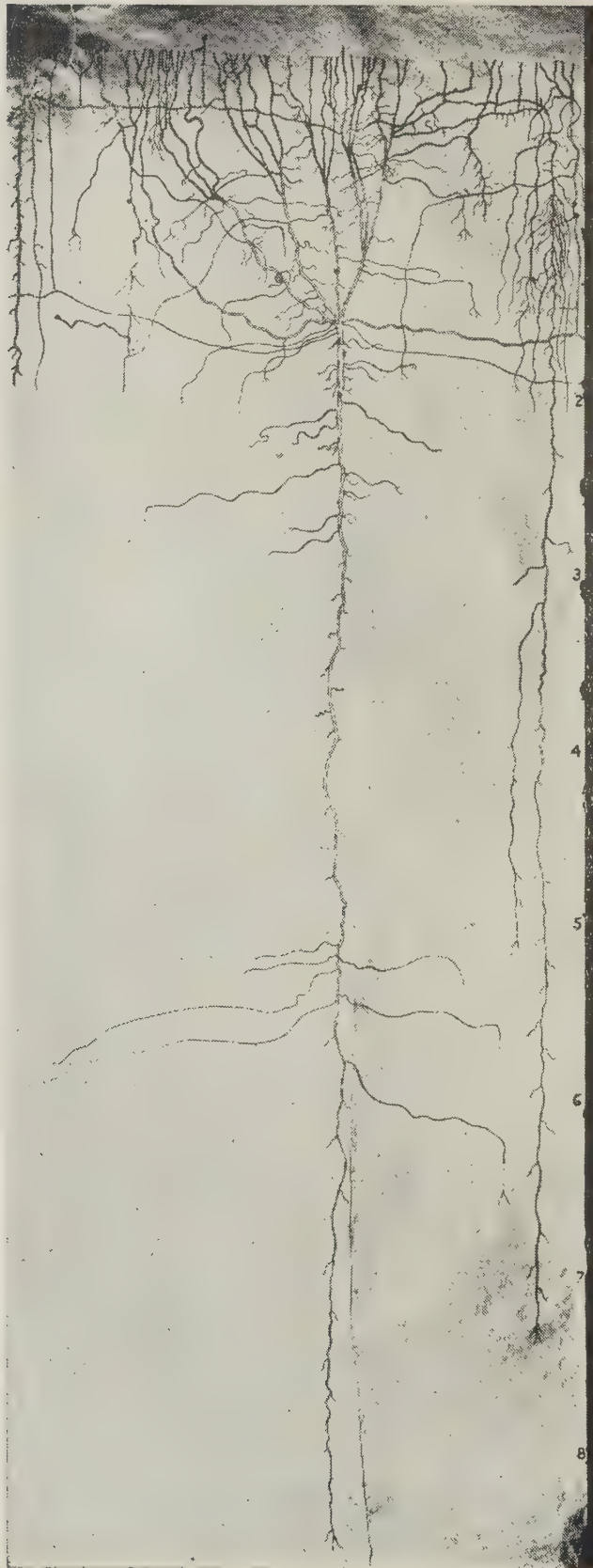




FIELD BINDWEED  
(*Convolvulus arvensis*, L.)



## FIELD BINDWEED



The main root of field bindweed may penetrate to a depth of 20 feet.



ground should be allowed at any time between cultivations. At the beginning of the eradication period it will be necessary to cultivate about every 2 weeks. Less frequent cultivations are necessary in the second year. Clean cultivations are absolutely necessary to success. Keep all cutting edges sharp and provide sufficient overlap to avoid misses in the field. When treating patches of the weed, start cultivation 10 feet beyond the outside of the patch and work in.

So far field bindweed is found in relatively small patches in Alberta, and should be handled by intensive cultivation or chemical. It might be mentioned, however, that fall rye will control bindweed effectively when used in combination with good cultivation. Fall rye may complete eradication if seeded at the end of the second year of fallow treatment. Spring crops have little value due to relatively low temperatures which do not promote sufficiently rapid growth of these crops in northern latitudes.

Certain perennial crops will control or reduce this pest to a considerable degree, though complete eradication will seldom result. For this purpose, crested wheat grass is unquestionably the most effective in dry regions. Alfalfa is satisfactory where it can be grown successfully, but it is recommended that creeping red fescue, Kentucky blue grass or brome be added, depending upon the suitability of each in the district. Pasturing the forage crop cannot be recommended unless the infestation is solid since pasturing spreads the weed markedly. Keep the forage growing vigourously by cultivation and the application of fertilizer. The crop should not be left down until it begins to fail. Plow it up and either complete eradication by cultivation or reseed after a season of fallow.

Sodium chlorate is reasonably effective in destroying field bindweed. Fall applications have been found most successful. Under favourable conditions, carbon disulphide will result in complete eradication, but in Alberta, the cost would be about \$2.50 for material and labour per 100 square feet.

Field bindweed is a heavy seed producer. It is estimated that up to 400 pounds of seed per acre may be produced. Moreover, 95 to 98 per cent. of the seeds possess a hard covering which will resist decomposition and permit the seed to live in the soil for many years. One test showed that, in an infested field, 80 viable seeds per square foot was found in the first six inches of soil, after two years of cultivation. One weakness of the chemical method of destruction is that few seeds are killed. After eradication of the old stand, reinfestation from seeds is a real danger. For a month after growth begins, bindweed seedlings are as easily killed as any annual. After eradication, a cropping system should be adopted by which seedlings can be prevented from becoming established.

HEDGE BINDWEED is common in certain heavy soil types of Alberta to which it is native. It is frequently confused with its more noxious relative. Its leaves and flowers, however, are about twice as large as those of field bindweed. The flowers are usually pure white and partly enclosed in a pair of large leafy bracts which are lacking in the case of field bindweed. On the latter, two small scale-like bracts are always found on each flower stalk about 1 inch below the flower. Moreover, the root systems are materially different. The spreading root system of hedge bindweed is shallow and is relatively easy to exterminate.



## Hoary Cress

(*Lepidium draba*; *Lepidium repens*; *Hymenophyssa pubescens*.)

Hoary cress is a perennial with greyish white foliage and erect stem 10 to 18 inches high, sometimes higher. The young plants have a rosette appearance and resemble stinkweed in shape. The flowers are white, about  $\frac{1}{4}$ -inch across and borne at the top of the stems. A field in bloom has a solid, snowy-white appearance; hence the weed is sometimes known as "whitetop."

Hoary cress roots have been found as deep as 30 feet. Mature plants send out running roots at different depths beneath the surface some of which are far below the depth of cultivation. The plant starts growth very early in the spring, frequently blooms in May. After blooming the seed stalks die, but other leaves form and remain green until frost, if moisture is available. Second flowering stalks are sent up only if the plant is cut or disturbed.

There are three distinct plants known as hoary cress and a fourth, perennial pepper-cress (*Lepidium latifolium*), is similar to them. Heart-podded hoary cress, (*Lepidium draba*), is distinguished by its heart-shaped, broad flat pod containing two seeds; another (*Lepidium repens*), is named lens-podded because of the lens shape of the pods which produce 2 to 4 seeds; the third (*Hymenophyssa pubescens*), is globe-podded. The pod of the latter has the appearance of being "blown up," is small, purplish and contains 2 to 4 seeds. It is doubtful if the heart-podded hoary cress is to be found in Alberta. The other two are widespread, prevalent in some districts, and are generally referred to as broad-leaved (*repens*) and narrow-leaved hoary cress. The difference in the size of the plants and their foliage is quite distinctive. Though differing somewhat in adaptation and habit, the same general treatment will control both species.

Most of the hoary cress now to be found in Alberta was introduced 20 or 30 years ago with imported alfalfa seed. However the weed has been introduced with brome seed. The weed would seem to be adapted to all parts of the Province. It thrives best on irrigated lands but does well on all the soil types in the better rainfall areas, and will grow under extremely dry conditions. Hoary cress, especially the narrow-leaved variety, seems to prefer slightly alkali soils and, when growing in such situations is most difficult to eradicate.

The length of time required to eradicate hoary cress by cultivation, varies from 2 to 3 years. By taking advantage of the fact that the young plants do not contribute food material for storage in the roots for a period after emergence, the cost of eradication can be reduced considerably. About 8 days growth above ground may be allowed between cultivations. If the period between emergence and cultivation is too long, however, much effort previously put into the job will be wasted. At the outset, it can be stated that little difficulty will be experienced in destroying the root system to the depth penetrated by cultivation. The greatest difficulty is to exhaust the food reserves stored in the deep vertical roots of the plant. It is important, therefore, that every vertical root be completely severed with every cultivation. Since the root is covered with a tough



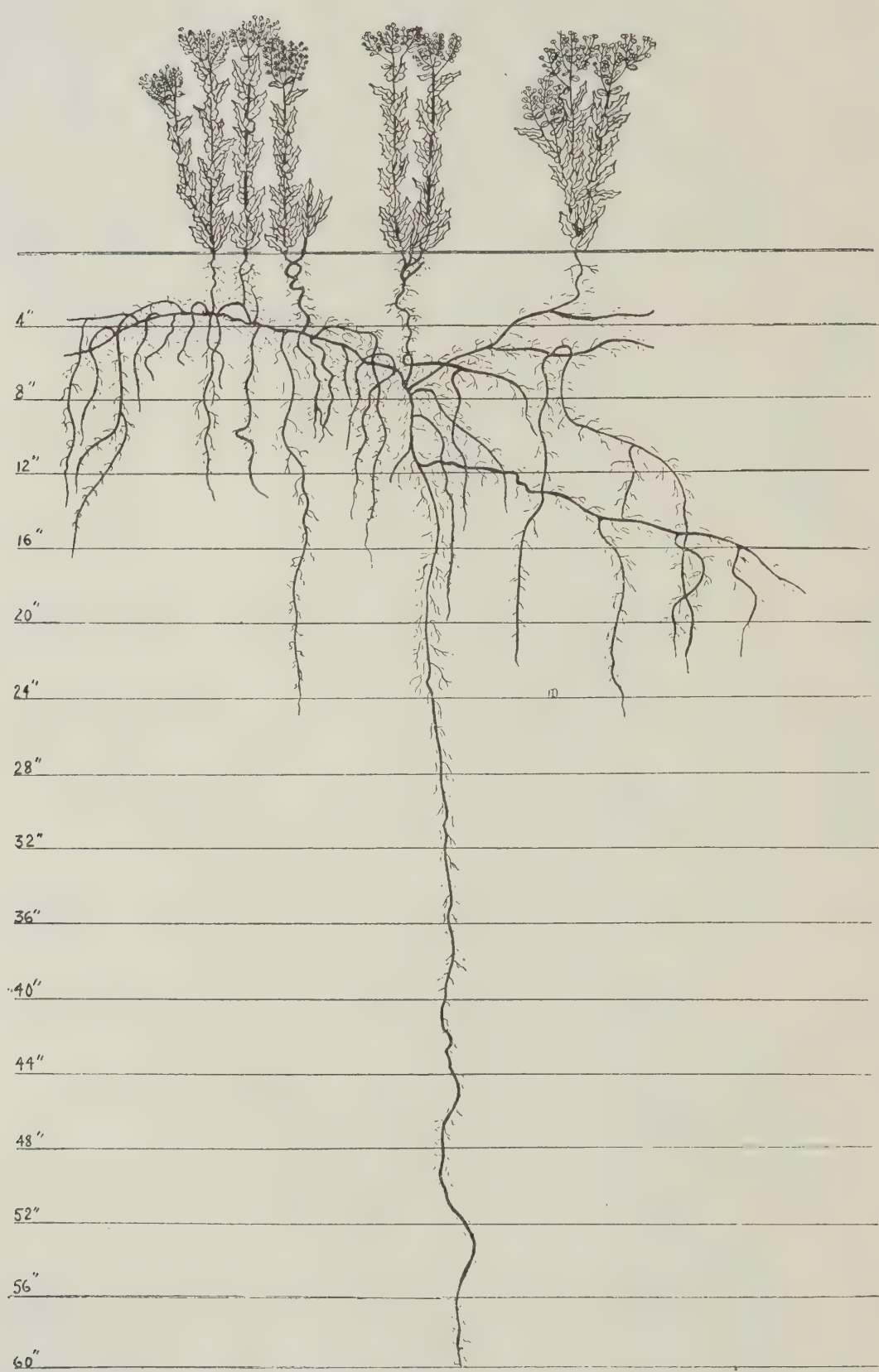


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HOARY CRESS  
(*Lepidium draba*, L.)



HOARY CRESS



Entire plant of hoary cress, showing proportion of root to top.  
The tap root may extend to a depth of 30 feet.



cork-like material, it is essential that all cutting edges be kept sharp and sufficient overlap provided to ensure that no misses will occur. One other point is that, since hoary cress makes most rapid growth in the month of May, it may be most efficiently eradicated if cultivations are begun early in the season.

Chemicals cannot be recommended for the eradication of hoary cress. It is frequently extremely resistant to sodium chlorate. In other cases, the roots may be preserved for a number of years below the depth of chlorate penetration and grow again when the soil toxicity created by the chemical is sufficiently reduced to permit it.

It is indicated that continuous burning will eradicate hoary cress in less than 2 years. The weed should be seared so lightly that the plant will not die for 24 hours and the treatment repeated when regrowth has occurred.

Neither alfalfa nor brome will check the spread of hoary cress. Alfalfa especially will not thrive in its presence. These crops should not be seeded even with the hope of effecting control. Where rainfall is sufficient to support them, turf-forming grasses such as Kentucky blue and creeping red fescue will control the weed, and, in some cases subdue it. In Nevada, a mixture of clovers and grasses controlled hoary cress on irrigated land which had been thoroughly cultivated for 1½ years before the forage crop was seeded. As described in a Nevada bulletin: "The (hoary cress), was not eradicated . . . . and there was no probability that it would be by the methods used. (But), at the end of the fifth summer the pastures were well established. Whitetop was still growing here and there in most of them but it did not amount to much." Where the production of crested wheat grass can be recommended in Alberta, there is evidence to support the conclusion that it will effectively control hoary cress, or, eradicate it entirely if the plant is sufficiently weakened by cultivation previous to seeding the grass.

In utilizing forage produced on land infested with hoary cress, care should be taken that weed seeds are not spread. The weed matures early and, unless precautions are taken, seed will be gathered with the hay. Moreover, it is established that cattle grazing on infested land may drop viable seed, days after their removal from the pasture. Where the weed occurs in small patches in the hay meadow or pasture, the formation of seed should be prevented by pulling or mowing. Hay from infested land should be stored until such time as it can be fed in an enclosure and the manure should be piled and well rotted before using.

The seed of hoary cress is not long-lived in the soil. In a test conducted under irrigated and dry-land conditions in California, no germination occurred in the third or fifth year after burial. Furthermore, observation in Alberta would seem to indicate that the weed spreads slowly where good farming is practised. This is probably due to the fact that the seedlings are easily destroyed and do not become sufficiently well established to withstand thorough cultivations between crops. When seeded with a forage crop incapable of offering strong competition, however, the plant becomes well rooted before the land is re-broken and again cultivated.



## Leafy Spurge

(*Euphorbia esula* or *E. virgata*)

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Leafy spurge usually appears in clumps. It is a perennial. Numerous stems grow each spring from the crown of the old root which branch out near the top of the plant in a cluster of flowering parts. It grows 2 to 3 feet in height. The whole plant exudes a milky sap. It bears a strong resemblance to flax, the leaves being smooth, narrow and without stems. The flowers are inconspicuous, pale yellow in colour, appearing through June to August. Frequently, seed in all stages of maturity as well as flowers may be found on the same plant. The seeds are silvery-grey to mottled brownish; oblong in shape; size 1/16-inch.

The roots of leafy spurge are reddish-brown, almost black in colour, woody and strong. The tap root forks in the first 2 feet of soil and its branches may extend to a depth of 10 to 15 feet. The creeping roots extend horizontally, usually 4 to 8 inches below the surface. The total underground parts of leafy spurge is enormous and it is not hard to understand why cultivated crops are unable to compete successfully against it.

Once a plant of leafy spurge is established a patch is soon developed. A seed planted in 1937, produced a plant 4 or 5 inches high the first year. In the year following, the seedling developed a root system and 9 new plants were produced from shoots. In 1939, the root-stocks gave rise to 150 more plants or a total of 160 in 3 years. At the end of that time the patch occupied an area 12 feet in diameter. Immature seed was produced in 1938 and mature seed in 1939.

Leafy spurge was introduced to Western Canada from Europe many years ago. Its origin in Alberta would seem to be with imported hay and forage crop seed. In this Province, the weed has been found on both heavy and light soils, but, whether due to accident or preference, most of the infestations have appeared on rather sandy to sandy loam soils.

Leafy spurge is an extremely difficult weed to destroy. Two years of complete fallow will sometimes not suffice. The frequency of cultivation necessary to prevent the translocation of food reserves from the leaves to the roots, does not seem to have been determined. Therefore, not more than one week should elapse between emergence and cultivation. The roots of leafy spurge are woody and tough; they are very difficult to cut, especially in loose soil. To eradicate, therefore, it is essential that all cutting edges be kept sharp and good overlap provided. It is suggested, that where conditions permit the use of a blade weeder, this type will

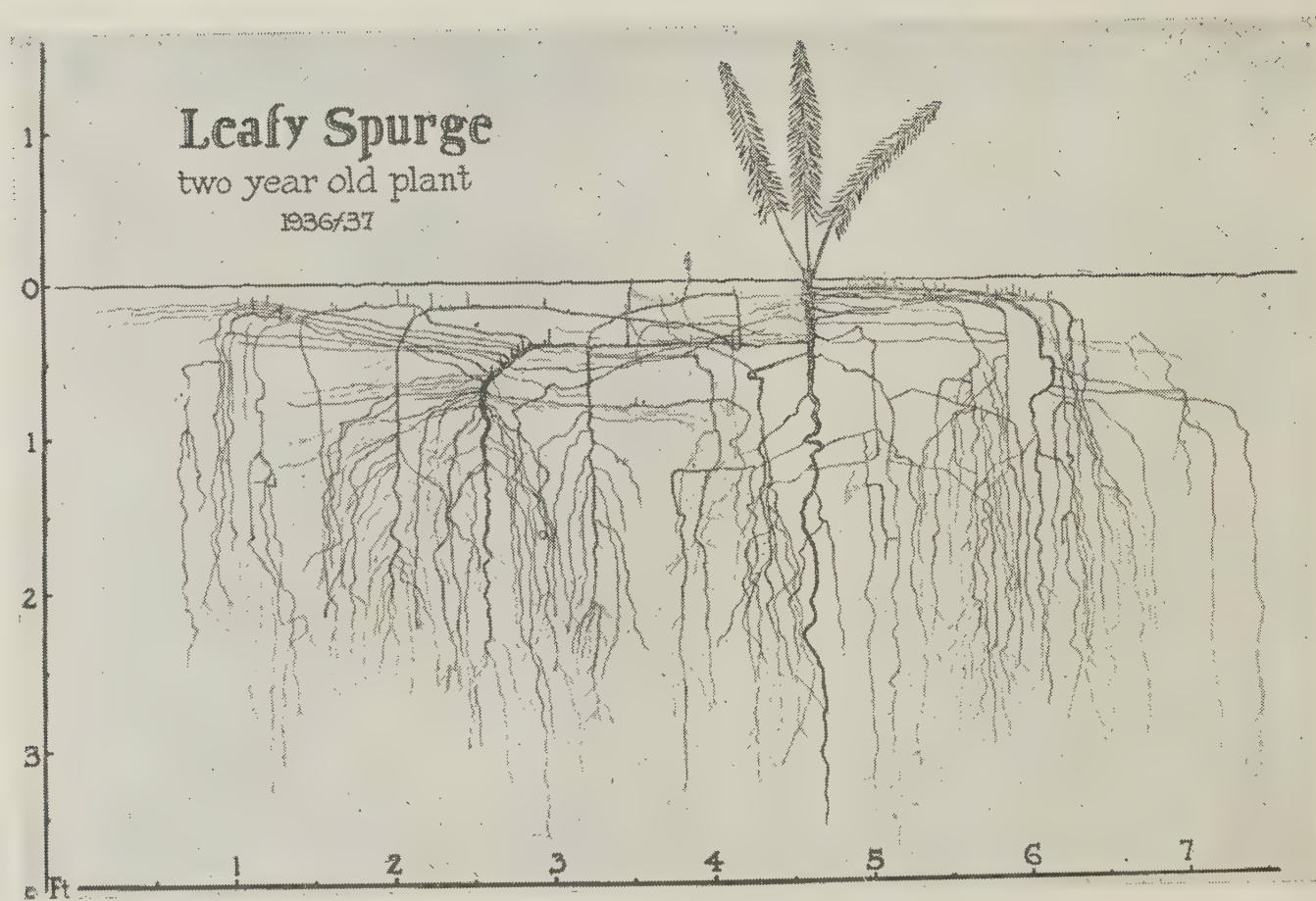




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LEAFY SPURGE  
(*Euphorbia esula* or *E. virgata*)





A large proportion of the leafy spurge plant consists of the root system.



be found most efficient. Any implement used must be rigid to do good work. If so worn or badly adjusted, as to take the line of least resistance down the field, little will be accomplished in the eradication of leafy spurge. Narrow-toothed cultivators and the disc harrow have little value.

Work on the eradication of leafy spurge by means of sodium chlorate shows variable results. In Manitoba it is believed that this method has proved sufficiently successful to warrant its use on an extensive scale. In that province Atlacide, a commercial preparation containing chlorate, is used at the rate of  $11\frac{1}{2}$  pounds per 100 square feet, for the most part directly to the growing plant as a spray. According to the Manitoba Weeds Commission, "The fall—even the late fall—is a good time to apply this chemical; but any time while the plant can be located will do." For the best results when a spray is used, the material should be applied in a fine mist under pressure. Follow-up applications will be necessary to complete eradication.

Leafy spurge commences growth very early in the spring and, for this reason, smother crops such as alfalfa are not effective in controlling it. Because of its unpleasant, acrid taste, farm animals show a dislike for leafy spurge. Moreover, the weed is sometimes classed as poisonous. However, some authorities indicate that sheep have been used to destroy it under close grazing conditions.



## Russian Knapweed

(*Centaurea picris*.)

### DISTRIBUTION

Russian knapweed is found in small patches in several widely separated localities of the Province. Many of the reported infestations are located in the irrigated districts of southern Alberta. The weed was probably introduced as an impurity in alfalfa seed. All fields that have been sown to Turkestan or imported alfalfa should be scrutinized for the presence of Russian knapweed. Farmers everywhere, however, should be on the watch for this weed. Its perennial habit, persistent growth and competitive ability make it an exceedingly troublesome weed to combat.

### DESCRIPTION.

Russian knapweed may be distinguished from other weeds by its characteristic lilac-coloured flowers in small round heads; by the tough, dark brown or black perennial roots; and by the rather shredded appearance of the mature plant when seen alone. The plant grows from 12 to 24 inches in height, and is well branched. The leaves on a mature plant are small and narrow, have smooth surfaces and edges, and have no pronounced point. The leaves are smaller towards the flower-head. Short, stiff hairs cover the leaves and stems, making them feel sticky to the touch. The upper parts of the stems of mature plants have the same hairy roughness as the leaves. The whole stem is hard, and practically inedible when dried in hay. Young stems are covered with a long, soft, gray nap, which remains upon the lower part of the stem. It does not appear on the branched parts of the flower-stalks, where the leaves are small. When the nap is removed from the lower part of large stems, a dark brown or purple colour is disclosed.

The first leaves formed in the spring are large, gray-green, and much longer than wide, with rounded teeth along the edge of the blade. The same long nap that covers the young stem is found upon these young leaves. The young leaves are so different from the leaves on the upper part of the mature stem that young Russian knapweed could easily be mistaken for some other plant. The young leaves vary greatly in shape, but when the stem is densely pubescent and attached to dark brown, tough, perennial roots, it is probable that the plant is Russian knapweed. Final proof of identification may be obtained by examining the flowers and fruit.

The lilac-coloured flowers are in small, round heads. The heads are less than  $\frac{1}{2}$ -inch in diameter, usually spherical, and are found singly on long stems. When the flowers are open, they give off a characteristic, rather pleasing odour.

The seeds are about  $\frac{1}{8}$ -inch long, approximately twice as long as broad, chalky-white, slightly wedge-shaped, and marked with fine, longitudinal lines.

The root system is similar to that of Canada thistle. Horizontal roots are produced, which bend downward at a short distance from the parent plant. Near the bend another root starts on a horizontal course for a few feet before it, too, bends down. Frequently a number of shoots arise close together along the outside of the bend, and grow up into a clump of plants. The vertical root will extend quite deeply into the subsoil.

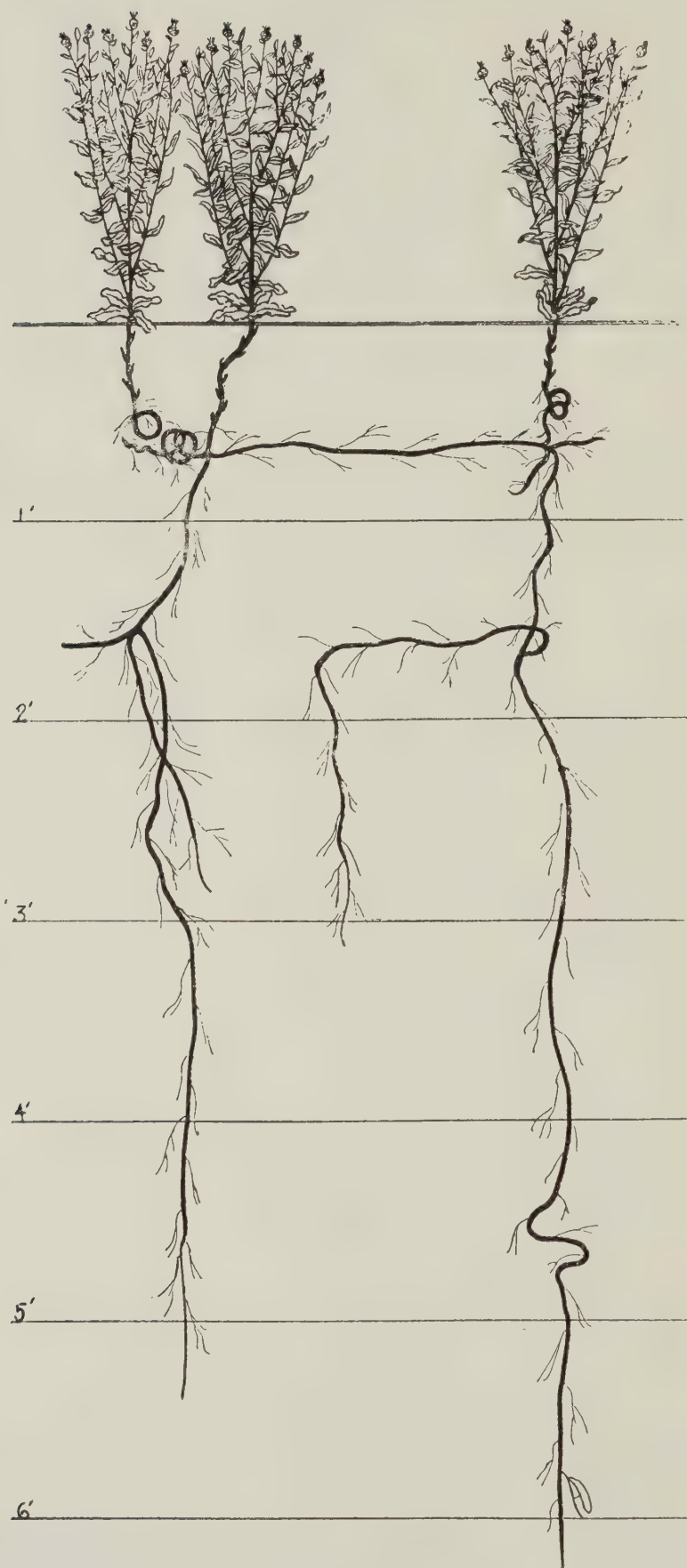




RUSSIAN KNAPWEED  
(*Centaurea picris.*)



## RUSSIAN KNAPWEED



Russian knapweed showing the proportion of root system to parts above ground.



## HABITS OF GROWTH.

The most outstanding characteristic of Russian knapweed is the persistence of its growth. It will survive almost any crop, and most methods of cultivation. Since it has no seed pappus to aid seed dispersal, it does not spread as rapidly as Canada thistle. However, its growth is much more persistent.

Its similarity to alfalfa in height and the way in which it blends with the leaves, stems and flowers of alfalfa, make its detection unlikely by the casual observer of a field, even at close range. Its appearance in alfalfa is probably due to its presence in imported alfalfa seed. Because of its close association with alfalfa, and its capacity to make pastures almost useless, it is particularly serious in alfalfa fields and pasture lands where grazing is heavy.

It thrives upon dry as well as irrigated land. It seems to have no soil preference, unless it be a damp clay, where moisture is likely to be abundant, and where the soft earth permits easy root penetration.

Russian knapweed seems to be able to survive almost any crop in any tillable soil in Alberta. It easily survives most methods of cultivation, and, if driven from much used places, takes refuge in out of way corners. When it grows unmolested it makes a perfect soil cover, and eliminates all other vegetation. Sod seems to have no effect whatever upon the Russian knapweed, for it has been known to spread steadily and rapidly in good sod pastures. It is not freely eaten even when green.

## ERADICATION OF LARGE INFESTATIONS.

The persistence and competitive ability of Russian knapweed limits the number of measures which may be practiced to eradicate it from large infested areas. Practically all investigators agree that two years of tillage are required for eradication.

*Cultivation:* Tillage operations for the eradication of Russian knapweed should commence early in the spring. Although an early start in spring may not reduce the number of cultivations necessary, it may result in eradicating the weed one year sooner than if the cultivations were not started until the plant had reached the blossom stage. Tillage operations should consist of early, deep ploughing, followed by sufficiently frequent cultivation, with a duck-foot cultivator or rotary rod weeder, to keep down all green growth. Shallow cultivation, 4 to 5 inches deep, is as effective as deep cultivation. During the first 6 to 8 weeks it may be necessary to cultivate about every 5 days. Later in the season, as the weed becomes weaker, cultivations can be less frequent, but they should be often enough to prevent growth above ground. Cultivation should continue well into the second season, as one year's summerfallow generally is not sufficient to eradicate Russian knapweed. A second ploughing in mid-summer will facilitate eradication. On areas using the rod weeder, a second ploughing may be essential; otherwise the weeder may pack the soil so firmly that the effective elimination of top growth may be impossible.

Smother crops cannot be depended upon to check a vigorous stand of Russian knapweed. They are reported to be useful after a summer-fallow to subdue the weakened plants that survived two years of fallow treatment. The most promising smother crop appears to be sweet clover. Grain, grass, and alfalfa, sown as smother crops, are not effective in checking Russian knapweed.

Hoed crops for eradicating Russian knapweed should follow a black summer-fallow. The land should be practically free from Russian knap-



weed before the hoed crop is sown; otherwise the additional work necessary to remove the weeds adjacent to the crop plants usually costs more than the advantages gained by a cultivated crop. Unless all Russian knapweed plants, especially those growing adjacent to crop plants, are removed every week, the hoed crop is not effective as a follow-up after a black summer fallow.

Under such an intensive system of cultivation as is required to eradicate Russian knapweed, it is difficult to take precautions against soil drifting; hence the importance of eradicating the weed before it has spread over a large field.

Large infestations cannot be eradicated economically by the use of chemicals.

#### ERADICATION OF SMALL PATCHES.

Single plants or small patches may be dug out and the roots burned. The place should be marked with a stake and watched for new growth, as small segments of the root missed in the first digging will develop into new plants.

Hoe every week during the growing season, for two years.

Chemicals used for the eradication of Russian knapweed have given variable results. Satisfactory treatments have been obtained by the use of sodium chlorate. It should be applied at the rate of 2 pounds per 100 square feet. The patches should be examined in 6 to 8 weeks, time, and, should there be any growth not killed, a further application should be made. During the succeeding year, it may be necessary to apply more chemical if the weed is not completely killed.

#### PREVENTION.

The cheapest and most effective means of protection from any noxious weed is the use of clean seed. Alberta's chief infestation of Russian knapweed is to be found in the irrigated districts where alfalfa is one of the principal crops. Alfalfa is responsible for the introduction and distribution of Russian knapweed in the United States. The same may hold true for Alberta. Under The Dominion Seeds Act, Russian knapweed is a prohibited weed. No Russian knapweed seed is legally permitted in any grade of any class of seed offered for sale. Protect yourself. Buy only graded seed.

All stray plants should be cut early in the season, and burned, in order that seed production may be prevented.

Avoid dragging cultivators, harrows and other machinery through small patches of Russian knapweed. To do so will spread the weed to other parts of the field. Isolate the patch; treat it as a separate field; and prevent the weed from spreading.

#### CONTROL.

Fortunately, Alberta has comparatively little Russian knapweed. The problem now is one of eradication. Our common crops and cropping methods usually fail to control the weed. Smother crops and hoed crops, given ordinary care, will not check a vigorous stand of the weed. Strenuous efforts should be directed toward the eradication of this pest.

Ploughing late in the fall, just before freeze-up, leaving the surface rough, may thin and weaken the root system. Fall ploughing might well precede a treatment of two years' summer-fallow, thus putting the land in shape to cultivate early the following spring.









PERENNIAL SOW THISTLE  
(*Sonchus arvensis*, L.)



## Perennial Sow Thistle

(*Sonchus arvensis*, L.)

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As implied by its name, this weed is a perennial. It propagates by seed and running root-stock. The latter is white in colour, fleshy and easily broken. In new patches the root-stocks arise at a depth of from 2 to 10 inches, but in old-established patches, they are usually restricted to the first 4 inches of soil. The tap roots extend from 5 to 10 feet deep and can establish new plants if severed at a depth of from 16 to 20 inches. The covering bark of the whole root system of perennial sow thistle is thin and weak, affording little protection against decay. According to Pavlychenko, this accounts for the fact that this weed is readily destroyed by continuous cultivations extending over 10 to 12 weeks or by means of chemical.

Perennial sow thistle commences growth rather late in the spring, usually not before the twentieth of May. The first leaves form a rosette and may be mistaken for dandelion. However, the leaves are thicker, stiffer and usually lighter green in colour, frequently tinged with purple. The plant grows from 2 to 5 feet in height and when broken exudes a thick, milk-white sap. The stem is hollow. The leaves vary greatly in size and shape; generally 4 to 12 inches long and deeply cut with divisions often pointing backward. They are edged with soft spines and clasp the stem with thin heart-shaped bases.

The flowers are bright yellow in colour, flat on top and about 1½ inches across. They usually close in bright sunlight. Blooms appear about the middle of July and continue to appear until late in the year. A papus or tuft of hair is attached to each seed by means of which it is distributed by the wind.

The seed is about ⅛-inch long, oblong in shape, dark reddish brown, with ribs running along it. Moist conditions and a rather high temperature are required for germination. The seed produced early in the summer usually shows a low percentage of germination but later in the season 90 to 100 per cent. germination is common. Seedlings quickly develop a strong tap root and may produce seed in the first year of growth.

Perennial sow thistle thrives in rich, moist soils. It is not a troublesome weed in the sections of the Province receiving 15 inches of rainfall or less annually, except where irrigation is practised. On waste lands in irrigated districts, and on lake shores and abandoned lands in areas of good annual rainfall the control of this weed is a big problem.

Most kinds of live stock relish perennial sow thistle and for this reason few pastures will be found with much of the weed showing. It is reported to have considerable feed value. Infested lands may be seeded down to



pasture and closely grazed until such time as eradication can be undertaken. Forage crops will not eradicate the weed unless the root system has first been weakened by a period of intensive cultivation. An exception of this may occur on wooded soils, where red clover and alfalfa sown with commercial fertilizer have effected satisfactory control.

With few exceptions, perennial sow thistle is not difficult to eradicate by cultivation. Most of the running root system of the plant is disturbed by cultivation at ordinary depths. The roots are brittle, and covered with a thin, weak bark which decomposes rapidly after a period of intensive cultivation. Sow thistle is easiest to destroy in a dry year; it is most persistent in deep, mucky soil, well supplied with moisture. It is important that upon each tillage operation every thistle plant should be loosened from the soil so that the sun and wind may complete their destruction.

Plowing immediately following the binder and later fall cultivation will reduce perennial sow thistle. On sandy soils and in a dry year this method may prove very effective. Late fall plowing is also beneficial.

#### PLANTS MISTAKEN FOR PERENNIAL SOW THISTLE.

Though not plentiful in Alberta as yet, annual sow thistle may be mistaken for the perennial of the species. The annual may be distinguished by its more profusely branching, lower growing habit, a fibrous root system and the lack of root-stocks. The flower is small and pale yellow in colour; the leaves are stiffish, very deeply notched and envelop the stem at the base.

Prickly lettuce resembles sow thistle in the early stages of growth, being similar in texture and exuding the same milky juice. It is an annual, however, and develops, about mid-summer, into a tall, spindly plant producing a lot of small, pale yellow flowers. At the outset, prickly lettuce may be identified by the number of spines on its stem and down the back of the midrib of each leaf. Because its leaves turn with the sun it is sometimes called compass plant.









CANADA THISTLE  
(*Cnicus arvensis*, L.)



## Canada Thistle

(*Cnicus arvensis*, L.)

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Canada thistle is a perennial weed introduced from Europe. It spreads by running root-stock and by seed. The plant grows 2 to 4 feet high, branches considerably and is very prickly. The leaves are dull green in colour, long, waved and crinkled, with a smooth, glossy appearance on the upper side while the lower surface is grayish, being covered with fine down. The flowers are purple to pink, some white. There are both male and female plants; the latter only produces seed. The males are distinguished by round, more or less bulb-shaped heads and partly by colour. The seed is  $\frac{1}{8}$ -inch long and bears a feathery pappus by which it is carried in the wind after maturity. Canada thistle seed may retain its viability in the soil for many years but requires moist conditions for germination.

This pest is widespread in Alberta but shows a preference for areas of greatest rainfall or in irrigation districts. Although not usually a regular seed producer, Canada thistle produces abundantly under Alberta conditions. The production of seed is reduced when the plant is grown in the shade.

The root system of Canada thistle consists of a tap root which may penetrate the soil to a depth of 8 to 12 feet, and root-stocks extending horizontally from the main stem at a depth of from 5 to 15 inches. The roots serve as a store-house for plant food and are covered with tough, corky material which protects them against decomposition. For this reason, Canada thistle is not easy to eradicate by cultivation, though it is possible to destroy the plant in one season.

Food reserves in the root system of Canada thistle, are lowest at the time the plant begins to bloom. It would appear, therefore, that cultivation should begin at the bloom stage. The first operation may be a deep plowing followed by surface cultivation at suitable intervals. We now know that it is not necessary to keep the land completely black to affect eradication. Young plants may be allowed to grow above the surface of the ground 8 or 9 days between cultivations. To prevent the loss of previous work due to wet weather or other cause, however, it would seem advisable to cultivate at intervals of about 6 or 7 days after emergence. In any case, the more frequent the cultivations the shorter the period required for eradication. The importance of complete, clean cultivation cannot be over emphasized. To eradicate the weed efficiently and in the shortest possible time, the cutting edges of all implements should be kept sharp and sufficient overlap provided to prevent missing even an occasional plant.



In the eradication of Canada thistle too many farmers neglect to give the summer fallow attention in the late summer and fall months. In the case of this weed it is very important that cultivation be continued until freeze-up or growth ceases. Fall cultivations are many times more effective than spring cultivations. Pieces of Canada thistle root-stock may remain dormant in the soil and survive the summer fallow. Therefore, to complete the eradication of a badly infested field the cultivation period should be followed by the production of a crop which will tend to smother re-growth. Then cultivation started immediately after harvest will complete the job.

The eradication of Canada thistle by the use of sodium chlorate has not been altogether successful. Its resistance to chlorate is due to the fact that the root system penetrates deeply, is protected by a tough outer bark and, cut off from the surface, can retain its viability in the soil for a number of years. Experiments conducted in Wyoming indicate that the weed can be more economically destroyed by continuous searing or burning.

The seeding of infested land to a forage crop will provide control and, if left in sod for a number of years, will eradicate Canada thistle. When used for hay, the thistles are cut at least once a year, which is an important factor in reducing and controlling the weed. If the forage is utilized for pasture it will be necessary to mow the thistles for a few years. The more frequently Canada thistles are cut the sooner they will be brought under control. It is recommended that the forage crop best suited to the district be utilized. The fact that alfalfa may be cut twice in a season increases its value in the control of perennial weeds. Alfalfa may be improved, however, by the addition of a creeping rooted perennial grass such as brome grass or creeping red fescue. Crested wheat grass will control Canada thistles in areas of low rainfall.









COUCH, QUACK, OR SCUTCH GRASS  
(*Agropyron repens*, L., Beauv.)



## Couch Grass

(*Agropyron repens*, L.)

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Couch grass is a perennial that propagates by running root-stock and by seed. The leaves are dark green in colour and distinctly ribbed. The root-stock tips are hard and sharp, a characteristic which is useful in identifying the plant. The seed resembles that of slender wheat grass but is borne on spikelets lying flat, rather than sideways, against the stem.

Other grasses likely to be confused with couch grass are western wheat grass (a native) and slender wheat grass (a cultivated species). The leaves of western wheat grass have a distinctly bluish colour, are quite rough and will roll up longitudinally when the plant suffers from lack of moisture. The leaves of couch grass suffering from drought, will wilt. Slender wheat grass is a bunch grass and may be easily identified by its fibrous non-creeping root system and its habit of growth.

Couch grass thrives in rich soils, well supplied with moisture. In Alberta it has long been a serious pest on our black soil areas, where the average annual rainfall is 16 inches or over. Further, the weed is most prevalent in the west and north of the area susceptible, which would seem to indicate that low summer temperatures are a factor favourable to the growth of the weed.

The root system consists of a mass of long stolons, vegetative buds and fibrous roots which may completely fill the soil. This mass of root material is formed relatively close to the surface of the soil if the weed is left undisturbed or is in pasture. However, on cultivation the root-stocks will be distributed to the depth of tillage. The results of investigations conducted in Manitoba under the direction of the National Research Council showed that couch grass root-stocks propagated most extensively when planted at a depth of 6 inches. At 4 inches deep, growth was slower while at 10 inches deep there was very little new growth and much of the root material rotted. Being fleshy and protected they resist considerable drying, but when air dried would appear to die in 15 days. All roots completely exposed to a bright sun for one day should be completely killed. In dry soil, however, they may go into a state of dormancy and remain alive for a considerable length of time or until moisture is again made available.

Couch grass seeds will germinate before they are fully ripe. Experiments conducted have shown that some grow "before the plant is fairly out of blossom." However, they do not retain their viability in the soil for many years. The U.S. Department of Agriculture reports—"seeds within the upper 3 inches either germinate or die within two years" although those



buried at greater depths may persist longer. They are readily destroyed in manure or ensilage.

Seedling plants of couch grass are easily destroyed up to the time root-stocks develop. This usually occurs at about 4 months after germination. Small patches may be repeatedly dug, cultivated or treated with chemical until eradicated. Two to three pounds of sodium chlorate per 100 square feet is required to eradicate this pest.

The fact that couch grass is most prevalent where rainfall is plentiful aggravates the problem of eradication, wet weather frequently interfering with the cultivation process. Shallow cultivation would seem to be the best. The aim should be to cut and break up the couch grass sod in the first tillage operations, that the roots may be brought to the surface and dried in the sun. Later the short pieces of root-stock left in the soil should be induced to exhaust themselves in new growth. Where weather or other conditions prevent the eradication of the weed in one year a crop should be seeded the following year that will most effectively smother regrowth until it is possible to summer-fallow or thoroughly cultivate again. Where it is required to "hold the ground gained" in the eradication of couch, fall rye provides an excellent smother crop while, under our conditions, barley is perhaps the most suitable annual for the purpose. To be fully effective the smother crop should be seeded early and shallow, at a heavier than normal rate of seeding.

If large areas are infested, undertake to clean up what can be properly handled with the equipment and power available. Couch grass hay is good feed. Seed down a part of the infested area. The best forage crop for this purpose has not been determined. However, timothy is excellent where conditions are favourable for this crop. It is also known that the root system of alfalfa offers serious competition to the weed. In seeding down, however, it would seem advisable to select a mixture of grasses and legumes. When couch grass is undisturbed for a few years, the root system develops near the surface and weakens. This condition is aggravated to the extent that greater development of the parts above ground can be stimulated. Discing in the spring or the application of fertilizer will stimulate the desired growth and at the same time improve the competition of economic forage species. After a few years of this treatment, couch grass will be much easier to eradicate.









SWEET GRASS  
(*Hierochloa odorata*, L.)



## Sweet Grass

(*Hierochloe odorata* (L.), Beauv.)

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Sweet grass is a native perennial grass, named because of its sweet scent. It propagates by seeds and running root-stocks. The root-stocks are rather deep-rooted and wide spreading, and send up new plants every few inches. The whole plant is bright green in colour, turning to golden yellow when mature. The flower stems are sent up early in the spring. The flowers are borne in loose panicles which contract and become a dark golden brown as the seeds ripen. Flowers usually appear in May, seeds ripening in June and July.

The seed is enclosed in the inner smooth scales. The naked seed closely resembles timothy and is often found in grass seeds such as timothy.

### CONTROL METHODS.

Sweet grass occurs more or less in practically every district of Alberta, but is found in more profuse growth in the park areas. It is easier to control and eradicate than quack grass, the same methods of eradication being employed.



## Toad Flax

(*Linaria vulgaris*, Hill.)

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Toad flax was introduced from Europe. It is a persistent, deeply rooted perennial. Its stems are erect, slender, becoming wiry. Leaves are stalkless, extremely numerous, mostly alternate, linear, without teeth or divisions, acute at both ends. The flowers are nearly an inch long, showy pale yellow with orange lips, borne in erect, dense racemes; the two-lobed corolla is closed and mouth-like, but, by gentle pressure at the sides, it opens and closes like the muzzle of an animal. In the early stages of growth, toad flax and leafy spurge are easily confused. At this time, care should be taken in their identification.

The seed of toad flax very much resembles that of the onion. Dark brown to black in colour, flat, round or oval, disc-like, roughened and surrounded with a circular wing as broad as the seed itself.

Toad flax was introduced for the most part, by settlers who brought it from Eastern Canada and planted it in their gardens. It has shown the greatest tendency to become a weed on heavy, loam soils. In suitable locations this weed will crowd out native grasses, and, when established, will completely prohibit crop growth on cultivated land. For this reason, it is difficult to handle on road-sides and in waste places.

Badly infested fields should be given a thorough summer fallow. Begin cultivations early in June and repeat frequently enough to prevent the storage of food material in the roots. The first operation should be to plow at a good depth, since, when undisturbed for some time, the root system consists of a tough mass of material which is difficult to penetrate and cut with surface tillage implements. Subsequent tillage may be done with the cultivator, rod or wire weeder, or a blade-type weeder. Best advantage may be taken of soil and weather conditions if a combination of these implements is used. It is most important that all growing plants should be cut at each tillage operation.

Toad flax is susceptible to sodium chlorate treatment and this chemical is recommended for the eradication of small patches. Apply 1 to 1½ pounds of the chemical per 100 square feet, either in the dry form or as a spray. Follow-up applications may be necessary.

As indicated above, this pest will crowd out native grasses in Alberta. Moreover, it has been observed that brome grass will not control it. Other grasses have been seeded with a view to determining their value in the control of toad flax. To date, however, the seeding down of infested land to any kind of forage crop cannot be recommended. Rather, infested grass lands should be broken up and thoroughly cultivated, for the longer eradication is delayed the more widespread will the weed become.



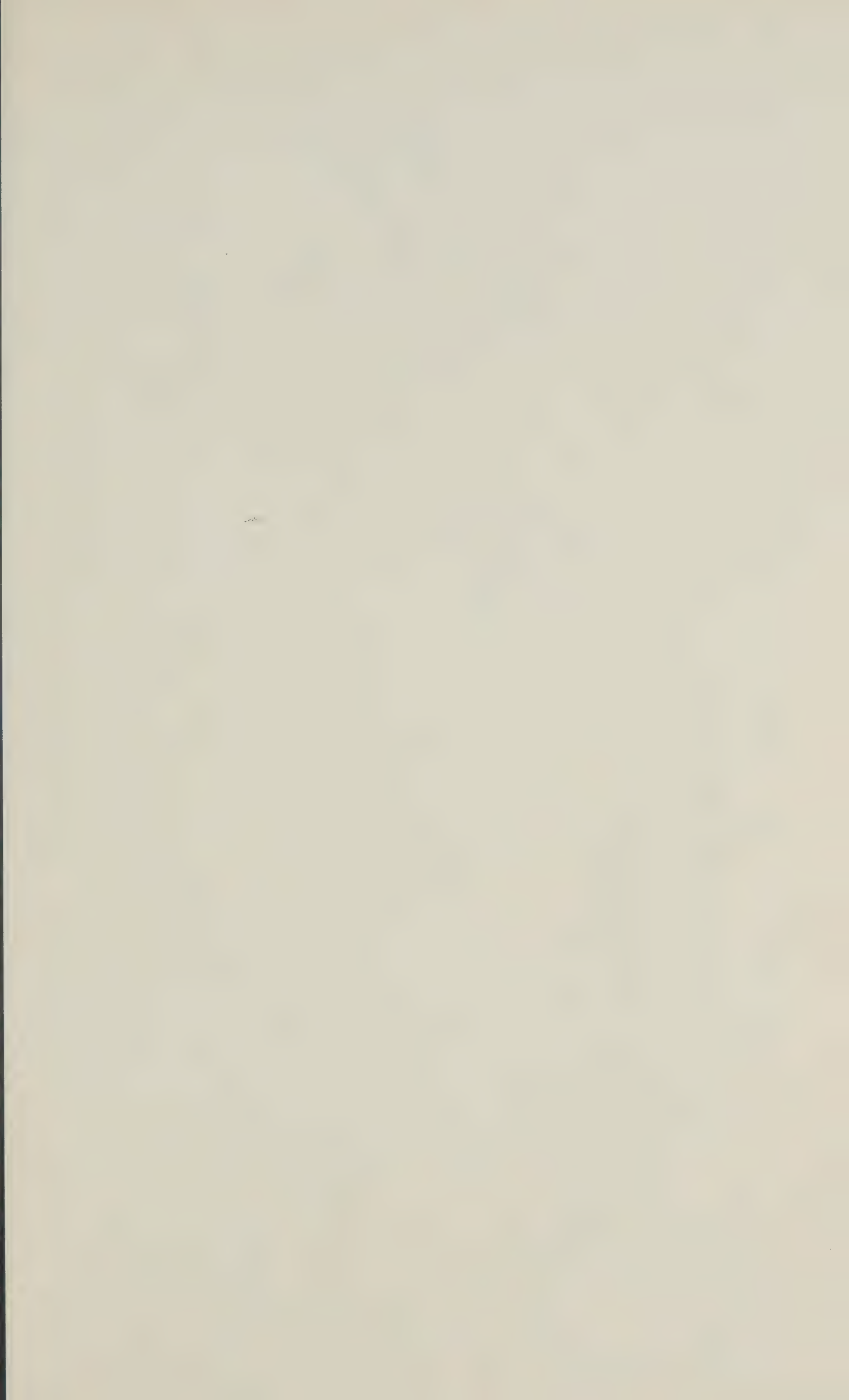


TOAD FLAX OR BUTTER AND EGGS  
(*Linaria vulgaris*, Hill.)













BLUE LETTUCE  
(*Lactuca pulchella*, D.C.)



## Blue Lettuce

(*Lactuca pulchella*, D.C.)

Blue lettuce is a deeply rooted native perennial with underground root-stocks. From the root, and also from the root-stocks, fresh stems are sent up. The stems are 2 to 3 feet high, being leafy below; the whole plant is smooth, covered with a fine bloom, filled with milky juice. Leaves are variable, linear, lance-shaped, or oblong; with teeth, or divisions, directed backward; stem leaves are less divided and stalkless. The flower heads are nearly 1 inch across, and pale blue in colour. The flowers are borne in panicles at the top of the plant.

The seed is about  $\frac{1}{4}$ -inch long, including the short, thick beak, the tip of which is whitish; expanded into a short, cup-shaped disc, red when immature, slate grey when ripe; club shaped, flattened with thick ridges down each face; whole surface dull and rough; pappus long, white, and silky.

It flowers from June to July, and the seed is ripe in August.

It propagates by seeds and deep persistent running root-stocks.

It occurs on railway grades, irrigation ditches, in grain-fields, on roadsides, etc. It is generally found in patches. Large patches are frequently seen growing in grain-fields, where they have completely choked out the grain.

While blue lettuce is not so difficult to eradicate as Canada thistle or perennial sow thistle, it should be eradicated as soon as noticed; or it will in a short time be the cause of greatly reduced yields.

### CONTROL AND ERADICATION.

#### *Large Infestations.*

In planning the campaign of eradication, it is necessary to keep in mind the following points; (1) complete eradication of the weed; (2) preservation of soil moisture for the following crop; (3) prevention of soil drifting; (4) economy of time, labour and horse-power. All these objectives may be accomplished by very shallow tillage, sufficient to inhibit top growth. The procedure consists of the following operations:

*Black summer fallow:* (1) In the middle of June the land should be ploughed with sharp shares to a depth not greater than 3 inches. A one-way disc may be used in place of the plough.

(2) The surface should be kept entirely free from top growth during the following 12 weeks by using a sharp disc, duck-foot cultivator, or rod weeder each time when new leaves just begin to appear above the surface. The plant can be destroyed by shallow cultivation irrespective of the depth of root penetration.



Due to the fact that only a very shallow layer of soil is affected by the cultivations, and that even this is usually left in ridges by the disc or duck-foot cultivator, the danger of soil drifting is small. If the top layer, however, is very susceptible to drifting, then the first ploughing after the treatment should be to a depth of 5 inches. This will bring up to the surface sufficient compact clods of soil to prevent damage from drifting. The shallow cultivation method requires comparatively little pulling power and therefore is economical and suitable for eradication on a large scale. This method, if persistently applied, usually results in the complete eradication of blue lettuce. An excessively wet season will tend to prolong the treatment for complete eradication. At the end of the treatment, the land is good summer fallow, and may be used for any crop desired.

#### *Small Patches.*

*Chemicals:* The eradication of blue lettuce by the use of chemicals has been very much to the fore in recent years. This method, although effective, is expensive, and therefore can be considered only for small patches or for the treatment of plants that are growing in inaccessible places. Chemicals are also practicable for the eradication of this weed on ditch banks, head-lands, fence rows, and even for small patches in the fields. It would cost about \$40 for chemicals alone to treat 1 acre of blue lettuce. Sodium chlorate has been found to be the most effective chemical. Applied at the rate of 1 to 1½ pounds per 100 square feet, it will destroy blue lettuce. The chemical is usually applied as a spray, although success can also be obtained by sprinkling the solution on the plants with an ordinary garden sprinkling can. Commercial weed killers containing sodium chlorate are effective in proportion to the percentage of the chlorate they contain.

*Hoeing:* Small patches in the garden or field may be eradicated by hoeing during the summer. The cultivation should be repeated as often as new leaves appear above the ground. Exposed roots should be gathered up and burned.

Dig out the roots of stray plants and small patches. The place should be marked with a stake so that the patch may again be visited to destroy any new growth that may appear from roots missed in the previous digging.

#### *Prevention.*

Sow only clean seed.

Prevent seed production by cutting off the plant as soon as flowers appear. Seeds mature in 10 days after flowering, but may germinate if cut earlier.

Breaking off the tops only encourages shoots from lower down on the stem to spring up and bear other flower heads. In cutting to prevent seeding, therefore, it is necessary that the plants be cut close to the ground.



Cultivate small patches separately, otherwise machinery will drag roots to clean parts of the field to start new patches.

### *Control.*

Complete eradication is desirable, but several difficulties may be encountered. Farms in badly infested districts are subject to re-infestation by wind-borne seed. Some farms are too badly infested to clean up in one year. It is therefore necessary to adopt measures which keep the weed under control while waiting for eradication, and also to adopt measures which prevent the weed from becoming established.

*Smother crops:* Barley sown late in the spring at from  $2\frac{1}{2}$  to 3 bushels per acre, on spring tilled land, germinates very quickly, and gives a thick stand which matures rapidly. This mode of control does not bring complete success, but is a valuable aid in reducing the growth of blue lettuce.

Generally speaking, the sowing of hay or pasture crops, such as alfalfa, sweet clover, or brome grass, is not an effective method to eradicate this weed from infested fields, although blue lettuce will seldom establish itself in a field of these crops.

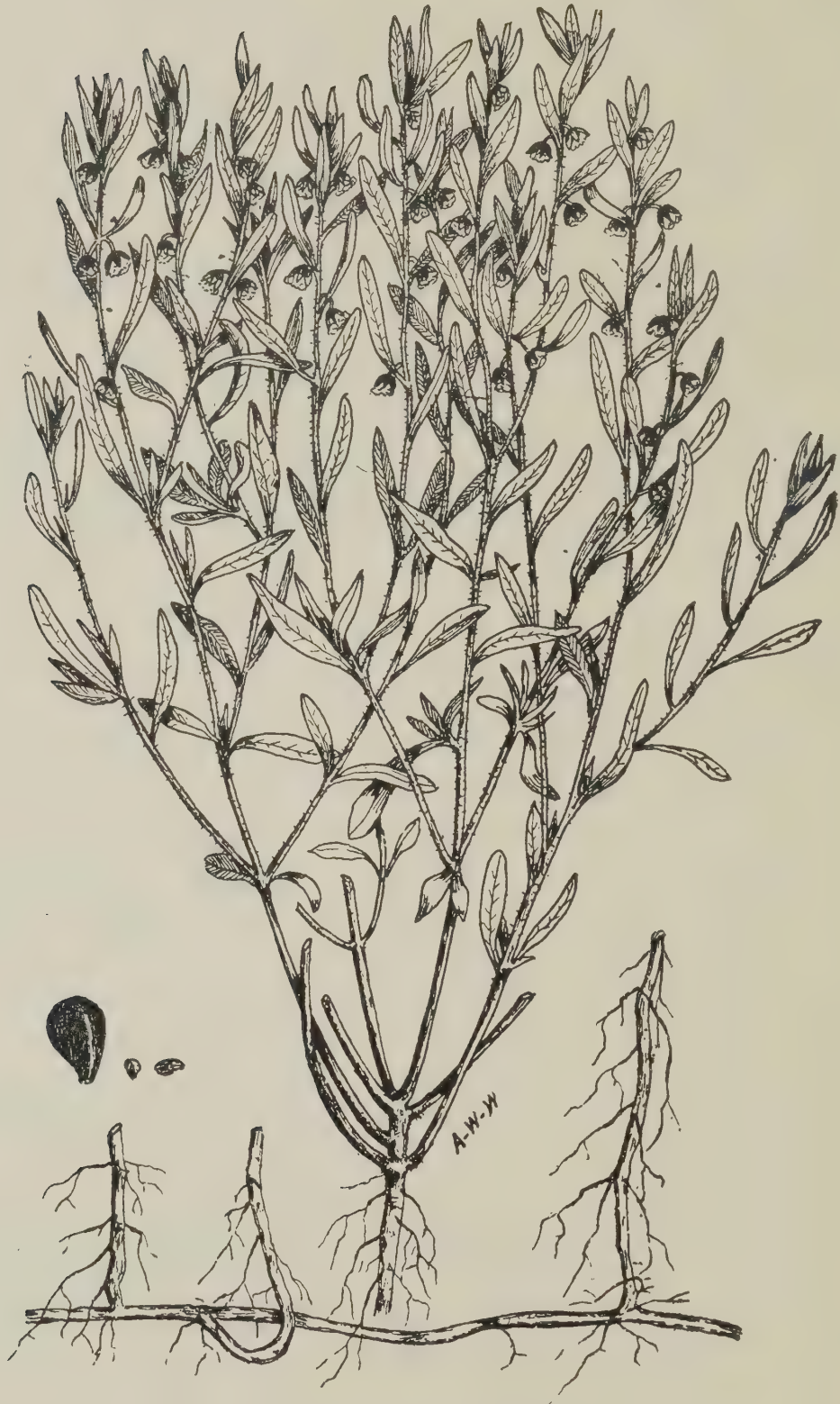
*Cultivated crops:* Cultivated crops offer one means of growing a crop and cleaning the ground at the same time. Two things are necessary, however; (1) the ground must be given sufficient attention to keep it perfectly free from weeds; (2) usually it should be partially cleaned beforehand, to allow the crop to make a good start.

*After-harvest cultivation:* After-harvest cultivation entails ploughing immediately after the binder, followed by cultivation until freeze-up, to keep down the green growth. It is very effective in some seasons, and in nearly every year the blue lettuce infestation can be greatly reduced. This method appears to be more effective in sandy than in heavy soils, and less effective in wet seasons.

*Late fall ploughing:* Late fall ploughing, just before freeze-up, if deep and left rough over the winter, will sometimes thin out and weaken the stand of blue lettuce.

Live stock are valuable in controlling blue lettuce. Pigs, particularly, are very fond of the roots, and patches may be completely eradicated by placing the pig-pen around them. Close pasturing of sheep and cattle along lake shores and river banks will serve to keep the weed from going to seed.





POVERTY WEED  
(*Iva axillaris*, Pursh.)



## Poverty Weed

(*Iva axillaris*, Pursh.)

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Poverty weed is a perennial, native to western Canada. It grows from 6 to 12 inches high. The stems are herbaceous, branching, and growing from creeping root-stocks. The leaves are thick, obovate to linear-oblong, without teeth or divisions, rough-hairy. The lower leaves on the plant are opposite, and the upper leaves are alternate. The flowers are quite small and inconspicuous. The plant has a rank odour. It is a persistent perennial, growing in patches, and is difficult to eradicate once it becomes well established. It spreads little if at all by seed. The roots penetrate the soil to a depth of eight feet or more.

Poverty weed is found on the very heaviest of soils, such as those in the area between Drumheller and Three Hills. It generally grows on patches of land that are slightly alkaline or not in the best physical condition for one reason or another. Usually this type of soil is rich, from the standpoint of mineral or chemical content, but is in poor physical condition or lacking in organic matter.

The heavy soil which this weed usually occupies breaks into clods when cultivated. When in this condition it is impossible to shake the soil from the roots of the plant which may be preserved on the surface of the soil throughout a considerable period of cultivation. The outer covering of the roots consists of tough, cork-like material which further assists to preserve them. Therefore, the improvement of the physical condition of the soil is important as a first step toward eradication. Work manure or rotted straw into the land. Summer fallow and seed to sweet clover. Plow under the second crop of sweet clover and summer fallow again. Seed to quick-growing crops that may be harvested early to permit fall cultivation. However, alternate fallowing and cropping will control rather than completely eradicate the weed. Poverty weed is reduced and stunted but not eradicated by a good stand of a forage crop.

It has been repeatedly demonstrated that poverty weed is susceptible to applications of sodium chlorate. Applications of from 1 to 1½ pounds per 100 square feet have been found very effective.



## Wild Oats

(*Avena fatua*)

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In spite of suggestions to the contrary, wild oats are an annual weed. They are closely related to tame oats but the two species can be readily distinguished. Wild oats usually grow somewhat taller, the panicle is spreading and the heavy awns are visible even in the field. The seed is black or greyish black in colour, slimmer and lighter in weight than the common varieties of tame oats. The most distinctive mark on the seed, however, is the horseshoe scar or "sucker mouth", which occurs at the base of the seed. This scar is surrounded by stiff hairs.

Wild oats take a heavier toll from agriculture than any other weed. They are moisture loving and are a most serious pest in the farming area adjacent to the foothills and in the north-central part of the Province. Wild oats give little trouble in areas of low rainfall except where irrigation is practised.

The ability of wild oats to persist in spite of efforts to eradicate them is due largely to certain characteristics possessed by their seed. A study of these characteristics will indicate the problem of wild oat control.

In the first place the seeds of wild oats are easily detached from the plant. They fall to the ground before they are fully mature. Moreover, the top kernels mature first and it is these that frequently re-seed the land before harvest while the kernels on the lower part of the head are frequently threshed with the crop and infest the seed for the following year's sowing. The longer it takes the crop to mature the more seed of wild oats fall to the ground. This explains the rapid increase of the pest, where straight grain growing is practised without the adoption of wild oat control measures.

The unpredictable germination habits of wild oats work strongly in favour of the weed. The seed will not grow immediately upon falling to the ground. Certain changes, or after ripening processes, are necessary before germination can take place. These occur more rapidly in dry, warm storage than in cold storage. This may account for the fact that wild oats are most troublesome where summers are short and temperatures in the spring and fall are usually low. Under these circumstances, the after ripening processes are not completed in the period between crops.

The seed changes are accompanied by drying and shrinking, a process which may be retarded by discing in the fall when the soil is wet. However, discing may be beneficial should the ground be dry after harvest. The value of fall discing land, (a) to be cropped the following year and (b) to be summer fallowed, would seem to require investigation. In the absence of more definite information, however, and in view of the fact that spring is a busy time on Alberta farms it is considered good practice to lightly disc stubble land in the fall whenever possible.





WILD OATS  
(*Avena fatua*, L.)







Another complicating factor is, that while warm temperatures are required to condition wild oat seed for germination, the actual process of growth is best between slightly above the freezing point and 50° F. At higher temperatures the process of growth may be arrested and the seed reverts to a dormant stage from which it can be aroused only in its own time.

Wild oats will germinate best when planted at a depth of 2.5 inches. At other depths a high percentage of dormancy occurs. When germination does take place at extreme depths, however, the ability of the young plant to reach the surface is surprising. The National Research Council reports emergence through 12 inches of soil. Another feature of the seed is that germination will not occur in loose, dry soil, or in soil that is packed so firmly as to exclude the air.

These facts suggest methods of soil treatment most likely to induce wild oats to "grow themselves out" on summer fallows or between cropping periods. Deep plowing which tends to preserve the seed in the soil should be avoided. Practice shallow cultivation instead. Keep the land firm and moist by packing after each tillage operation. This will increase germination. Cultivate when each crop of seedlings has reached the 3 to 5 leaf stage. In earlier stages of growth the weed may be transplanted rather than destroyed.

The peculiar temperature requirements of wild oats, to complete ripening processes and to germinate, together with added requirements as to depth and preparation of the seed bed, explain why the summer fallow may aggravate rather than reduce the problem of wild oat control. The practice of plowing and intensively cultivating the soil during the period of warmest summer weather, too frequently add up to waste effort. Constant stirring of the soil will not reduce the weed seed population of the soil. Plan to leave the soil in the state of a seed bed after each cultivation and leave it alone until maximum germination is secured.

Wild oat infestations in crop can be reduced by the adoption of certain proven practices. The shortness of our growing season, limits the extent to which delayed seeding to permit the reduction of the weed seed population in the soil by spring cultivation, may be practiced. But to the extent that it is feasible this practice should be followed.

More practical in Alberta would seem to be some lessons, learned as a result of certain experiments conducted in Saskatchewan. The results indicate the value of seeding cereals early, at a shallow depth, at heavier than normal rates and with commercial fertilizers. In the parkland area of the province,

"We recommend early seeding of the crop to secure its germination ahead of weeds, shallow seeding to have quick emergence, and fertilizing to provide a rapid development of the crop. We recommend heavier seeding to accelerate the formation of a dense mat of cereal roots so as to smother weeds more effectively, to avoid misses in the rows and to quickly shade the spaces between the rows."

These practices reduced weed infestations and increased yields proportionally. Their success is explained by the fact that wild oats require



3 to 5 days longer to germinate than do common cereals, and that their root systems are small in the early stages of growth. At the seedling stage the weeds succumb to the competition of cereal crops planted under favourable circumstances.

Wild oat seeds are relatively short-lived in the soil. Most experiments show the mortality of all buried seeds in three years. An exception at Indian Head showed that only 4.5 per cent grew at the end of that time. Therefore, a rotation that will prevent the plant from seeding for three or four years should eliminate the pest. Such a rotation is possible only on farms on which a fair amount of live stock is kept. The basis of the best type of rotation would need to be a forage crop and may be utilized for either hay or pasture. The forage crop may be seeded with a nurse crop harvested for green feed. Alfalfa or a mixture containing alfalfa, will perhaps provide the best control of all common weeds.

The use of fall rye in wild oat control is effective because of its early spring growth and heavy stooling habit. Moreover, fall rye is harvested early, permitting considerable after-harvest cultivations. Heavy stands of barley have a similar effect. Select an early maturing variety and seed late. Cut on the green side if necessary to prevent shattering of wild oat seeds.

As indicated, wild oats are a most serious problem where oats are depended upon to a large extent. This brings into significance, the fact that wild and tame oats are closely related and that crosses between the two occur frequently in the field.

The product of the first cross between tame and wild oats, cannot be distinguished from the tame mother plant or seed. But reproduced again, many of the hybrids revert to a true wild oat type. Oats grown on wild oat infested land for a number of years become a mixture of types containing intermediates of every degree. These possess in varying degrees the unpredictable germination habits of the true wild oat.

For this reason, it is important that oat stocks used for seed should be changed regularly. The purest stocks of seed probably contain some intermediate oats but by purchasing registered or certified seed, the danger of re-infestation from this source is reduced to a minimum. It is suggested that oat growers should purchase enough high quality seed each year to keep a seed oat plot. This will reduce to a minimum the danger of seeding the weed and give some assurance that effort put forth in its control will not be lost through rapid re-infestation.









WILD MUSTARD  
(*Brassica arvensis*, L., otherwise *Brassica sinapistrum*)

## Wild Mustard

(*Brassica arvensis*, L., otherwise *B. Sinapistrum*)

Wild mustard is becoming widespread in many districts of Alberta. People who come from Ontario know that this is a very serious annual weed, and requires very intensive measures to bring it under control.

### DESCRIPTION.

Wild mustard is an annual, introduced from Europe with the early settlers. The stems are erect, and branched, growing from 1 to 3 feet in height. They are generally rough, with stiff, downward directed hairs. A striking characteristic of this plant is a purplish colouration at the junction of the branches with the main stem. The lower leaves are usually borne on stems, indented, or lobed, the terminal lobe being somewhat larger than the others. The upper leaves are mostly stemless. The roots are fibrous. The flowers are yellow, showy, and about 2/3-inch across. The seed-pods are from 1 to 2 inches in length, ribbed, and rise obliquely on short stalks. The seed-pod is tipped with a long, empty beak, which breaks away whole when the pod is ripe. The seed-pods are also slightly constricted between the seeds, and each pod contains from 15 to 17 seeds. Strong plants will produce up to 10,000 seeds. The seeds of wild mustard vary somewhat in size, but are generally 1/16-inch in diameter, quite round, dark brown or reddish black, and are very similar in appearance to turnip seeds. The plant flowers from June to September, and seeds are ripe by August. Being an annual, it propagates by seeds only, and, therefore, control measures must be of such a nature as to prevent the formation of seeds, or to cause germination of the seeds already produced, in order that the resulting plants may be destroyed before they produce seeds.

### HABITS OF GROWTH.

The seed will remain buried in the soil and retain its viability for many years. The seed will germinate and emerge earlier than the earliest sown cereal crop. Recent experiments indicate that fall cultivation may be of no advantage in wild mustard control. Wild mustard appears to germinate as well if not cultivated. Seeds germinate best from shallow depths.

### CONTROL.

Two important principles of mustard control are; to germinate the seed; and to destroy the plant before seed is produced. Seed buried deeply will not germinate and, therefore, will take years to grow it all out of the soil. It is comparatively easy to destroy mustard plants on bare land, and on land sown to cultivated or hay crops, but until recently we have had no satisfactory means of destroying mustard plants in grain crops.



During recent years, methods have been developed to reduce the mustard growth in grain crops. These methods should be adopted and practised from year to year, since any successful programme of wild mustard control must be continued over a long period of time.

*Green Summer fallow:* Fields which are already badly polluted with wild mustard should be given special attention. If sufficient moisture is obtained during the fall, a large number of the seeds will germinate, and the plants will be killed by the frost during the winter. In the spring of the year no cultivation should be given to the land until the mustard plants have reached a height of 3 to 4 inches, at which time the weeds should be destroyed by surface cultivation. About a month after this date, providing moisture conditions are favourable in the interim, another crop of mustard will have grown, and this should be destroyed in the same manner. This procedure should be repeated several times during the season. Care should be taken that the land is not disturbed during the period from August 10th to September 15th, due to the danger of cut-worms. In the spring of the year, providing the land is fairly clean, wheat may be sown, but if mustard seeds are still present, it is advisable to sow a crop such as barley, which will crowd out the young mustard plants.

*Seeding Practises:* The critical period of competition between crop and weeds is during the first three weeks of growth. The quicker and more completely the soil can be filled up with crop roots, the more likely will the crop survive, and smother wild mustard. A dense, uniform stand of crop is important for the success of the crop in competition with weeds, and may be promoted by the following; (1) the use of seed showing strong vitality and high percentage of germination; (2) sowing on a well prepared seed bed; (3) sowing heavier than usual. Wild mustard will emerge earlier than the earliest sown spring cereals. It would therefore appear a safe procedure to delay sowing cereals on soil polluted with wild mustard until a crop of weeds had been germinated, and been destroyed by cultivation. If this practice is followed, it is important to sow the crop immediately after cultivation so as to give the crop an equal start with the weed seed not yet germinated. Land infested with wild mustard should be sown to crops best able to compete against the weed. Of the cereals, barley is our best competitor. The cereals, arranged in the order of their decreasing competitive ability, are as follows;—hannchen barley, prolific spring rye, marquis wheat, banner oats.

*Chemical Treatment:* The use of chemicals, particularly sulphuric acid, in the control of wild mustard is being given greater consideration as time goes on. In some parts of the world, particularly France, sulphuric acid is widely used in the control of certain annual weeds, among which are the mustards. Sulphuric acid, applied as a spray, with a concentration of 5 per cent. by weight of sulphuric in water, at the rate of 100 gallons per acre, is recommended in Alberta. This spray may be applied directly to the grain crops, when the grain is about 6 inches in height,

and the mustard is at that time about 4 inches in height. In most cases no permanent injury to the grain is caused by the application of the sulphuric acid spray. Sulphuric acid is cheap, and its use should prove profitable, but suitable and inexpensive spraying machinery has not been developed for Alberta conditions. As soon as satisfactory equipment is made available, at a reasonable cost, the spraying of mustard infested grain crops is a practice that should be considered in wild mustard control.

*Crop Cultivation:* Another method suggested for the control of this weed in growing crops, is to harrow the crop two or three times until the grain is 6 inches high. This operation will pull out many of the young mustard plants. It is advisable to seed the grain a little heavier in order to make up for the loss sustained by harrowing.

#### PREVENTION.

Sow only clean seed.

Clean farm machinery before moving from one field to another.

Feed only clean grain to live stock. Excess mustard seed in feed is injurious to the health of animals.

Pull and burn stray plants. Do not allow any mustard plants to go to seed on the farm.





WILD RADISH

*(Raphanus raphanistrum, L.)*

## Wild Radish

(*Raphanus raphanistrum*, L.)

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Wild radish was introduced from Europe. It is an annual and winter annual. It grows from 1 to 3 feet high. It is often confused with wild mustard. It has a yellow flower with purplish veins on the petals. The flowers are fewer and larger, and somewhat paler than those of wild mustard. The seed-pods are composed of two joints, and have no valves; the lower pods are small, seedless, and remain attached to the foot stocks. The upper ones contain several one-seed cells. The branches, starting near the base of the plant, are few; the leaves are deeply lobed, and of a pale green colour. The leaves and stocks are covered with short, stiff bristles.

It flowers from July to September; its seeds ripen in August and September.

The seed is about 1/10-inch long, and varies much in size and shape. It is usually oval, slightly flattened, and is a light reddish-brown in colour.

Its occurrence is becoming from year to year more frequent in many districts of this Province.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.



## Tartary Buckwheat

(*Polygonum Tartaricum*, L.)

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Tartary buckwheat is a weed which is spreading rapidly in north-central Alberta.

### DESCRIPTION.

Tartary buckwheat is an annual. The stems are erect, branched, and usually as tall as the grain crop. The leaves are shaped like an arrow head, often broader than long, and from 1 to 4 inches wide. Flower stalks arise from the ends or from the axils of stems. Usually they are solitary, with but few whitish flowers. The seed is somewhat pointed, grayish sand colour, and  $\frac{3}{16}$  to  $\frac{4}{16}$  of an inch long. Its angles are crested with prominent lobes above the middle. The faces of the seed are grooved.

### NOXIOUS CHARACTERISTICS.

The seed is difficult to remove from wheat. Very small quantities in grain will cause it to be graded "rejected". The plant is a prolific seed producer.

### CONTROL.

*Hand Pulling:* Tartary buckwheat on slightly infested fields should be pulled by hand. The weed germinates early, and is of considerable size, and easily seen when the grain is only a few inches high. If pulled at this time, a field may be kept fairly free from the pest.

*Seeding Practices:* Since it germinates early, a crop of weeds may be destroyed before seeding the grain crop. The grain should be sown immediately following the cultivation to destroy the pest. This will give the crop an equal start with the ungerminated seed in the soil.

A dense, uniform, rapidly growing crop will tend to have a smothering effect on tartary buckwheat. This result may be attained by adopting the following practices;—sowing heavier than normal; preparing a good seed-bed; sowing barley rather than wheat or oats; and sowing seed possessing strong vitality and high percentage of germination.

### *Green Summerfallow:*

(1) Crop year: Soon after harvest, cultivate or disc the infested field to a depth not greater than 2 inches, harrow, and pack the surface immediately.

(2) Summer fallow year: In the spring, leave the land undisturbed until a heavy growth of weeds attains a height of from 4 to 5 inches. At this stage destroy the plants by surface cultivation, and a few days later



TARTARY BUCKWHEAT  
(*Polygonum Tartaricum*, L.)





harrow and pack the land firmly. Under average conditions a rather heavy crop of weeds will be present in about a month's time. This growth should be destroyed as before. By repeating these operations throughout the summer fallow year, a number of crops of weeds may be killed.

(3) Crop year after summer fallow: If the weed seeds have not all been grown out, it is preferable to sow the summer fallowed field to barley, as a smother crop, rather than to wheat or oats.

#### PREVENTION.

Sow clean seed. One of the chief means by which tartary buckwheat is distributed throughout the Province is by impure seed. The seed is extremely difficult to remove from seed grain, and for that reason it is not advisable to use grain for seed which has been grown on infested land. Make a personal examination of all seed purchased.

Newly infested fields should not be ploughed deeply. It is advisable to cultivate shallow and attempt to grow seeds out of the soil, and destroy subsequent plants by cultivation.

Feed properly crushed grain to live stock.

Clean farm machinery moving from an infested field on the farm.

See that all threshing outfits are properly cleaned before leaving an infested field.



## Downy Brome Grass

(*Bromus tectorum*, L.)



### DESCRIPTION.

Downy brome grass is an early maturing annual and winter annual grass. In general appearance the plant is slim and weak, quite leafy, and seldom grows to a height exceeding 2 feet. The leaves are softly hairy, and turn to a lavender colour when mature. The plant blooms from May to July, and the seeds ripen from June to August. The panicle is one-sided, drooping or nodding, rather dense, and from 2 to 6 inches long. It often turns purple upon approaching maturity.

### DISTRIBUTION IN ALBERTA.

The most numerous infestations of downy brome grass in Alberta are to be found in the south-western portion of the Province. Outside of this area, downy brome has been found at a number of widely scattered points. The locations most heavily infested are towns and cities, highways, and around the buildings of farms and ranches. Other locations on which the weed will be found are farm windbreaks, edges of fields, alfalfa meadows, heavily over-grazed farm pastures and ranch lands, gardens, railway rights-of-way, abandoned crop land, and waste places. At present the downy brome infestation is confined to a relatively small portion of the Province, but the weed threatens to become more widely and densely distributed. The whole of the dry belt or prairie section of Alberta is susceptible to heavy infestation.

## SOURCES OF INFESTATION.

Downy brome grass was introduced into Alberta in hay and Alfalfa seed. Alfalfa hay from infested fields is a distributing agent. The camping tourist who visits infested auto camps carries the seed from place to place on tents, bedding and clothing. In a few cases, packing material around nursery stock has been responsible for introducing the weed. Live stock moving from infested areas will carry downy brome seeds in their coats.

## NOXIOUS CHARACTERISTICS.

*Mechanical injury to live stock:* The barbed seeds may cause sore mouths in live stock, and may work into the eyes and cause blindness. Cases are on record of seeds causing strangulation and death.

*Fire hazard:* Dry downy brome is easily set on fire, and, when once started, the fire spreads rapidly. In some regions an increased infestation of downy brome has become accompanied by an increased number of prairie fires.

*The seed* has barbs which help it cling to various objects, and thus aid its dispersal.

*Smut:* Downy brome is frequently infested with a smut which also attacks desirable grass crops.

*Unpalatability:* Matured stems are unpalatable, and not nutritious. They lower the feeding value of hay and pasture.

The presence of downy brome indirectly leads to the deterioration of infested grass lands. Prairie fires, so often associated with downy brome, are injurious to desirable species. The pasturing of downy brome early in the spring, when it is palatable, occurs at a time too early for most grasses. The carrying capacity due to the presence of downy brome may be over estimated, to the detriment of the desirable species.

## HABITS OF GROWTH.

Downy brome propagates only from seed, which may germinate in the fall or spring. The plant matures early in the season. Downy brome does not readily invade a vigorous stand of native grass. It occupies vacant spaces in crops of alfalfa and winter grain, and tends to crowd out these crops. It will invade areas of native grass weakened by over-grazing, and of abandoned crop land supporting a growth of weed plants. Downy brome is an indicator of over-grazing. It invades an area after the native vegetation has been destroyed or weakened by premature grazing, over-grazing, excessive trampling, or any other cause which leaves the soil surface bare.

## PREVENTION.

To prevent the introduction of the weed;—

- (a) Use only clean seed and clean hay.
- (b) Destroy packing material accompanying nursery stock.
- (c) Clean all tents, bedding, etc., after camping in infested auto camps.

To prevent the weed from becoming established;—

- (a) Avoid over-grazing and premature grazing of native grass lands.



- (b) Feed infested hay in enclosed yards.
- (c) Practice a system of rotational grazing to strengthen stands of native grass.
- (d) Seed abandoned crop-land, earth-works and waste places to grass.
- (e) Avoid excessive trampling, and give desirable grasses a chance to flourish.

### CONTROL.

The vegetation which normally occupies uncultivated land is a product of the environment. If the environment includes undesirable practices long continued, weeds invade the area, and little or no progress can be made in their control until better practices have been adopted. The only permanent method of controlling downy brome on uncultivated lands is to establish a vigorous stand of desirable grasses.

Depleted range lands can be re-grassed by natural re-seeding of native grasses. This can best be accomplished by a system of delayed and rotational grazing.

Abandoned crop land which has not completely "gone back" is susceptible to infestation by downy brome. The natural re-seeding of this land is slow. The process may be hastened by seeding with crested wheat grass. Sow a drill-width, or three single rows to a drill-width, every 50 to 100 feet across the direction of the prevailing wind. Sow in the fall,  $\frac{1}{2}$ -inch deep, without preparing a seed-bed. Strip seedings must be protected from stock until the grass has become established. Permit no grazing before fall, until two good crops of seed have been produced. In subsequent years, grazing should be light enough to permit the production of some seed.

A vigorous stand of grass cannot be maintained if it is continually overgrazed. There appears to be only two remedies for over-grazing,—reduce the number of stock, or increase the size of the pasture.

Burning reduces the danger of spreading. Isolated patches should be burned. Thin stands will not readily burn, and should be covered with straw or other inflammable material to help carry the fire. Do not attempt to burn too large an area at once. Secure a permit from the police before burning.

### CONTROL MEASURES FOR SPECIFIC INFESTATIONS

#### *Alfalfa meadows:*

- (a) Spring cultivate with spring-tooth harrow.
- (b) Plough badly infested fields.

#### *Small grain-fields:*

- (a) Avoid sowing winter grain.
- (b) Thorough spring cultivation.
- (c) Provide conditions promoting a uniform stand of grain—good seed, well prepared seed-bed, fertilization.

#### *Farm windbreaks:*

Cultivation.

*Waste places, including highways, railway lands, fence rows, and inaccessible places:*

- (a) Burn isolated patches.
- (b) Cut, rake, and burn.
- (c) Sow to grass, and permit the grass to flourish.
- (d) Avoid premature and excessive grazing.

*Towns and Cities:*

- (a) Burn isolated patches.
- (b) Cut, rake, and burn.
- (c) Sow to grass.
- (d) Avoid destruction of desirable grasses from excessive trampling, unrestricted traffic, or over-grazing.

*Abandoned crop land:*

- (a) Burn isolated patches.
- (b) Sow to grass.
- (c) Prevent premature and excessive grazing.
- (d) Adopt a system of rotational grazing.

*Range land:*

- (a) Prevent premature and excessive grazing.
- (b) Adopt a system of rotational grazing.
- (c) Burn isolated patches.

#### UTILIZATION

Downy brome makes good pasture at lambing time when no other grass is available. The period of good pasture, however, is limited to only a few weeks (4 to 6) in the spring. Downy brome is sometimes put up for hay. For hay, it should be cut while immature to avoid mechanical injury to the stock to which it is to be fed. Downy brome hay comes in the same category as that of Russian thistle, in as much as it provides fodder when no other feed is available.





NIGHT-FLOWERING CATCHFLY

*(Silene noctiflora)*

## Night-Flowering Catchfly

(*Silene noctiflora*, L.)

Annual and winter annual, introduced from Europe. The stem is 1 to 3 feet high, rather stout, branching. The whole plant is covered with soft, spreading, glanular hairs and a sticky substance in which small insects are often caught. The lower leaves are ovate, narrowed at base; the stem leaves are lance-shaped. Its few, large, creamy white flowers open at night or during a cloudy day and close when the sun is shining. The fruit capsule is six-toothed at the top; the calyx is marked with ten prominent green nerves and five long teeth at the apex. The plant has a pungent flavour and woody texture which makes it objectionable to live stock, whether in pasture or cured fodder, and when at all prevalent in hay a considerable waste results.

Night-flowering catchfly is found in increasing quantities in Alberta. It is a rank grower and heavy seeder and is particularly troublesome in clover fields. Its seed is about 1/20 of an inch in diameter, very slightly flattened, dull greyish brown, with 8 to 10 curved rows of tubercles on each side. It cannot be separated from alsike except by the use of special machinery, and consequently alsike which contains this weed seed is much reduced in value. It is almost as difficult to separate from timothy and red clover.

Since this weed propagates entirely by seed, it can be eradicated by (a) inducing the seeds already in the soil to germinate and destroy the seedlings; (b) prevent the plant from seeding; (c) sow clean seed. Catchfly will not long persist on land worked under a short crop rotation. It has become troublesome in the parts of Alberta growing alsike and Altaswede clovers and timothy, due to its presence in the seed first introduced. In these areas every effort should be made to get rid of it by hand pulling while only small quantities are present. In special cases it may be advisable to harvest the heavily infested portions of a seed crop early and utilize it for live stock feed.





HEMP NETTLE  
(*Galeopsis Tetrahit*, L.)

## Hemp Nettle

(*Galeopsis Tetrahit*, L.)

Hemp nettle is an annual, introduced from Europe. The stems are erect, tall, swollen below the joints, rough and hairy. The leaves are ovate, with strong, forward-pointing teeth, tapering at the end, and borne on slender foot-stalks. Flowers purplish, white or variegated, grouped in clusters at the axils of the leaves. The teeth of the calyx are needle-pointed and very sharp when the plant is mature. The seed is greyish-brown, resembling cultivated hemp but smaller, about  $\frac{1}{8}$ -inch long.

This weed is becoming a pest in the deep, rich peaty soils of the Province. In suitable locations, it occupies much space and will completely crowd out the crop. The extremely prickly nature of the plant when mature, renders it impossible to handle feed containing this weed by hand. Moreover, its presence seriously lowers the value of feed for live stock.

Since hemp nettle is an annual, the theoretical method of control would be to cause the seeds in the soil to germinate at a time when the seedlings could be destroyed and to sow clean seed. However, the seed of hemp nettle is covered by a hard coat and is difficult to germinate. Under laboratory conditions, seed stored in various ways can be induced to germinate only one or two per cent. over a long period of time. Only by treating the seed with such an agent as nitric acid can germination up to 20 to 25 per cent. be secured. Germination is improved in the laboratory by raising the temperature.

The number of seedlings which appear in the field would indicate that germination is better under natural conditions. However, too little is known to indicate exactly how growth can be assisted to the end that control might be affected. It is suggested that a shallow-cultivated summer fallow, kept firm and moist will give most satisfactory results. The fact that germination is improved when the temperature is raised would indicate that early seeding might assist in the control of the weed.

Practise crop rotation. Seed infested areas to permanent grass. Close cutting for a few years will suppress the weed in waste places and this should be accompanied with an attempt to improve the growth of grass.



## Corn Spurrey

(*Spergula arvensis*, L.)

### DESCRIPTION.

Corn Spurrey is an annual introduced from Europe. The stems, which curve upward, and branch from the base, are 6 to 18 inches high, almost smooth, and slightly hairy above. The leaves are narrow and linear, 1 to 2 inches long, apparently in a circle around the joints of the stems, but really in two opposite sets of six or eight together, with scale-like modified leaves between them. The flowers are white,  $\frac{1}{4}$ -inch across, open in sunshine, and grow in clusters with the central flowers opening first; the tiny seed boles hang downward.

The seed is very small, dull black, lens shaped, or round and compressed, with the margin extended into a narrow pale wing. The surface of the seed is somewhat roughened, with small, hair-like formations on them.

Corn spurrey propagates by seed only, flowers in July, and the seeds ripen in July and August.

It is becoming widely distributed in the park areas of the Province. It is seldom found on the prairies in southern Alberta, but usually occurs on sandy acid soils, and on wet, acid, cultivated peat soils.

### HABITS OF GROWTH.

It does not appear to be very persistent on grass-lands.

In some countries it has been observed that corn spurrey was more prevalent in oats, less prevalent in barley, less prevalent in wheat, and still less prevalent in grass and clover crops.

Corn spurrey is a prolific seed producer. The seeds retain their vitality for a long time when lying dormant in dry soil. Growth is very rapid, and may smother out root crops, young grasses or clovers, and grain.

The plant matures early in the season, and drops the seeds during the late summer and fall.

### CONTROL MEASURES.

Harrow the growing crop two or three times in the spring.

Sow clean seed.

Pasture with sheep while the plants are young.

Disc or harrow grain-fields after the crop is removed, to induce seeds to germinate.

Grain or clover crops may follow a well tilled cultivated crop.

Badly infested areas should be summerfallowed by giving a light surface cultivation in the fall or early spring. When the corn spurrey plants appear, cultivate off with a narrow toothed cultivator, or duck-foot cultivator if suitable. As the plants appear, repeat the cultivation. A duck-foot cultivator will usually work after the first cultivation with a narrow shovel machine. Each cultivation should go a little deeper to bring up more seeds of the plant to the place in the soil where they will germinate. Deeply buried seeds will not germinate; therefore, summer fallow should not be ploughed deeply until the seeds near the surface have been grown out. If the season is at all moist, this system of eradication will prove effective.





CORN SPURREY  
(*Spergula arvensis*, L.)











WORM-SEED MUSTARD  
(*Erysimum cheiranthoides*, L.)

## Worm-Seed Mustard

(*Erysimum cheiranthoides*, L.)

Worm-seed mustard is a native annual and winter annual. Its stems are erect, simple, or branching, 6 inches to 2 feet high. The whole plant is sometimes slightly hoary with short star-like hairs. Leaves are dark green, lance shaped, sparsely toothed. The flowers are bright yellow and about 1/5 of an inch across in terminal clusters about 1 inch across on gradually elongated racemes. The seed-pods are slightly curved, from 1/2 of an inch to 1 inch long, obtusely four-angled, erect on spreading foot-stalks. Each pod contains about 25 seeds. A full grown plant produces about 25,000 seeds.

The seed is of a reddish-yellow colour, about 1/24 of an inch long, uneven sized, and shows a furrow on one side. The scar end is darkened. The seeds are very bitter, and are not relished by live stock.

It flowers from June to fall. Seeds ripen from July to freeze-up.

It propagates by seed.

It occurs in waste places and on cultivated land in the West. Quite common in Alberta. Usually found on poorly cultivated fields.

### CONTROL METHODS.

Sow clean seed.

Hand-pull when in small patches, and burn.

Cultivate shallow after the binder. The following spring, cultivate or plough again when the young plants appear. Seed at once. Harrow the growing crop once or twice when it is from 3 to 6 inches high. Then hand-pull and burn any remaining plants when they come into flower.

Fall or spring cultivation followed by clean summerfallow is usually very effective. For the summer fallow, plough early in June and cultivate when young plants appear, or pasture with sheep. The following spring, cultivate as shallow as possible with a duck-foot cultivator, and seed at once.

Seed a hoed crop, or seed to rape and pasture with sheep.

Burn all screenings and stack bottoms, also straw stacks that are badly polluted.

Keep all roads, fence allowances and waste places clean. They serve as breeding ground for weeds unless they are watched at all times during the growing season.

Seed down to permanent pastures. Pasture closely until the grass takes complete possession of the soil.





COW COCKLE  
(*Saponaria vaccaria*, L.)

## Cow Cockle

(*Saponaria vaccaria*, L.)

---

This is an annual, introduced from Europe. It grows from 1 to 3 feet high; stems erect, branched above, and much branched from the base. The entire plant is smooth, succulent, and of greyish-green appearance. The flowers are pink, about  $\frac{1}{2}$ -inch in diameter; calyx ovate, inflated, and finely ribbed. The flowers are succeeded by smooth, rounded capsules, containing about 20 seeds.

This weed is becoming more general in the Province, particularly in wheat-growing districts. It is a vigorous grower, and robs the crop of moisture, as well as crowding out the grain.

It flowers in July; seeds ripen in August.

The seed is about  $\frac{1}{12}$ -inch in diameter, round, finely pitted, and a dull black in colour. The seed looks somewhat like the seed of wild vetch.

### CONTROL METHODS.

Sow clean seed.

Hand-pull stray plants.

Fall and spring cultivation will aid greatly in holding it in check.

Seed down to grass, such as timothy, brome, or western rye, for a period of from 3 to 4 years. This greatly reduces the number of plants.

Harrow the growing crop several times to kill the seedling plants.

A clean summerfallow is also effective.





COCKLE BUR

*(Xanthium strumarium, L.)*

## Cockle Bur

(*Xanthium strumarium*, L.)

---

Cockle bur is a native annual coarse growing weed, from 1 to 3 feet high, considerably branched. Its leaves are large, heart-shaped or ovate, and dark green in colour. The flowers are borne on different parts of the plant and along branches in clusters. The male flowers are borne above, the female below. The burs are about 1 inch long, and are thickly covered with strong spines which are curved at the ends. The seed retains its vitality for a number of years. The bur sticks to the hair of live stock, and is especially troublesome to sheep if the burs get into the wool, as it irritates the skin, and reduces the value of the wool.

It flowers during July and August; the seed ripens during August and September.

This weed occurs mainly in southern Alberta, along railways, streams, and has begun to make its appearance in a few cultivated fields.

### CONTROL METHODS.

Sow clean seed.

Hand-pull, if not too numerous.

Keep all waste places and pastures cut with a mower.

Where whole fields are infested, a thorough summer fallow is recommended.

In the spring, harrow the grain two or three times after the crop is up.

After harvest, skim-plough shallow, or cultivate with a disc, to induce the seed of the plant to germinate that fall or early next spring.



## Ball Mustard

(*Neslia paniculata*, L.)

---

Ball mustard is an unusual weed, introduced from Europe into the West. It is sometimes a winter annual. Stems erect, 1 foot to 4 feet high, very slender. Strong plants throw out a few long branches. The whole plant is a yellowish green, and is covered with small fine hairs. Lower leaves are lance shaped and narrowed at the base; stem leaves are arrow shaped, clasping the stem at the base, blunt pointed. Flowers are orange yellow and  $\frac{1}{8}$  of an inch across. The seed pods are round, borne on the end of short slender stems. They are greenish yellow when ripe, and do not shed their seeds readily. Each pod contains only one seed, which is of a pale yellow colour. Seeds are somewhat difficult to clean out of grain because of their size.

Ball mustard flowers from June to August, and seeds ripen from July to September.

It occurs in grain fields, on railroads, earthworks, and in waste places. It propagates by seed.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.



BALL MUSTARD  
(*Neslia paniculata*, L.)











HARE'S-EAR MUSTARD  
(*Conringia orientalis*, L.)

## Hare's-Ear Mustard

(*Conringia orientalis*, L.)

Hare's-ear mustard is an annual and winter annual, introduced from Europe. It is an erect growing plant, 1 foot to 4 feet high. The whole plant is perfectly smooth, and when young is covered with a fine bloom like that of a cabbage. Leaves are somewhat fleshy, without teeth, oblong, oval, entire, and clasping the stem by two rounded lobes. They resemble in shape a hare's or rabbit's ear. Flowers are a creamy white, about a  $\frac{1}{4}$  of an inch across. Seed pods are square, and 3 to 4 inches long.

It flowers in June and July. Seeds ripen during August and September.

It propagates by seed.

The seed is dark brown in colour,  $\frac{1}{12}$ -inch long, granular, roughened. When soaked in water it is covered with short, erect, white, mucilaginous hairs. It resembles in shape the common false flax.

It occurs quite generally throughout the West, especially in southern Alberta, in grain-fields, in stubble, and by road-sides.

### CONTROL METHODS.

Sow clean seed.

Hand-pull small patches and stray plants when first noticed.

Harrow the grain once or twice when 3 to 6 inches high.

Disc or skim-plough immediately after harvest. Plough early the following spring, and work the surface. Then allow to stand until about June 1st. Cultivate well with duck-foot cultivator or rod weeder, then seed thickly to barley.

Summer fallow badly infested areas. Keep the summer fallow clean till freeze-up with cultivation, or by pasturing with sheep.

Use a hoed crop, or sow to rape and pasture with sheep.

Burn all screenings and stack bottoms, also straw stacks that are badly polluted.

Keep all roads, fence allowances and waste places clean at all times.

Mustard seed should be fed sparingly to live stock, and should be ground before feeding to all live stock except sheep.



## Green Tansy Mustard

(*Sisymbrium incisum*, Engelm., var. *S. filipes*, Gray)

---

Allied species: gray or crowded tansy mustard, *Sisymbrium incisum* (Engels.), var *Hartwegianum* (Fourn.), (Watson), resembles green tansy mustard very much, excepting that the colour is a darker green and the plant is covered with short, grey, downy hairs. It is more erect in habit of growth. The same methods of control will be found satisfactory as for green tansy mustard.

Green tansy mustard is a native biennial. During the first season it grows as a rosette of finely divided leaves lying on the ground. Stems 1 foot to 4 feet high, erect, widely branching at the top, and bearing a large number of narrow, smooth, slightly curved pods, from  $\frac{1}{2}$  to  $\frac{3}{4}$ -inch long, on slender, spreading foot-stalks. The whole plant is a light green. The leaves are divided into 5 segments. The flowers are yellow,  $\frac{1}{8}$ -inch across in an elongated raceme.

The seed is small,  $\frac{1}{25}$ -inch long, and somewhat oblong in shape.

Time of flowering is June and July; seeds ripen in August.

It propagates entirely by seed.

It is general throughout the Province. There are districts where it is a serious menace, choking out and doing damage to grain crops.

### CONTROL METHODS.

Do not sow crops such as fall rye or fall wheat, or stubble in seed on ground infested with this weed.

See "Control of Annual Weeds," page 6.



GREEN TANSY MUSTARD  
(*Sisymbrium incisum*, Engelm., var. *S. filipes*, Gray)











FALSE FLAX  
(*Camelina sativa*, L., Grantz)

## False Flax

(*Camelina sativa*, L., Grantz)

---

Introduced from Europe, false flax is an annual, and sometimes a winter annual. It grows erect from 2 to 3 feet high. It branches almost entirely from the upper portion of the stem. The bottom leaves are lance-shaped, and the upper leaves quite sharply arrow shaped; both upper and lower leaves clasp the stem. The lower leaves and the lower part of the stalk are downy, while the upper part of the stem is quite smooth. The flowers are numerous, small and borne in loose clusters. They are rather inconspicuous, and yellowish-green in colour. The pod is pear shaped, with a small projection from the upper end. Each pod is borne on a slender foot-stalk, curved upward, and containing about 10 seeds.

It flowers from June to August; the seeds ripen from July to September. The seed is about 1/12-inch long, pale yellowish-brown in colour, and somewhat resembles a miniature wheat seed. The seed is very oily, and, when ground with cereals, gives the meal a bad flavour.

### CONTROL METHODS.

Sow clean seed.

Hand-pull stray plants, and burn.

Avoid winter crops on land polluted with seeds of this weed.

Disc, or shallow plough in the spring before seeding.

Harrow two or three times the growing spring crop.

Land infested with this weed should always be cultivated after harvest and at intervals until winter sets in. Badly infested areas should receive a thorough summer fallow, with cultivation the previous fall, and continuous cultivation throughout the summer.



## Tumbling Mustard

(*Sisymbrium altissimum*, L.)

---

Tumbling mustard is an annual, sometimes a winter annual. It was introduced into the prairie provinces from Central and Southern Europe about 1887. It grows 2 to 4 feet high, with stem branching, the lower part and the root leaves downy and glandular; with a musky odour. It appears first as a rosette of soft, pale green, downy leaves, resembling those of the dandelion. The upper leaves of the plant are much finer than those at the base of the plant.

The flowers are a pale yellow, 1/3-inch in diameter. Seed pods are 2 to 4 inches long, very slender and produced abundantly along the branches. Each pod contains from 50 to 125 seeds. A single plant may produce over one million seeds. When the seeds are ripe the whole plant breaks off and is blown across the prairie, scattering the seeds as it travels

The seed is 1/25 of an inch long, olive brown or greenish yellow, minutely roughened with mucilaginous glands, oblong, angular, cut off transversely at the scar end, sometimes almost square from compression in the pod, grooves conspicuously darkened.

It flowers from June to freeze-up; seeds ripen in August.

It propagates by seed.

It occurs mostly in those areas of the west where moisture is a distinctly limited factor in crop production and where the soil has a very considerable percentage of sand in its composition. It is seldom found growing on black humus soil or in the park or forest areas of the west.

It spreads very rapidly, due to its tumbling habit. It is a rapid and vigorous grower, and if at all plentiful will soon choke out a grain crop.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.





TUMBLING MUSTARD  
(*Sisymbrium altissimum*, L.)











RUSSIAN THISTLE  
(*Salsola kali*, L.)



## Russian Thistle

(*Salsola kali*, L.)

Russian thistle is an annual, introduced from Asia. It is a bushy plant with a prickly appearance, due to the long, thick, thread-like, prickly leaves, and the short, spiny bracts on the flowering branches of the older plants. As the plant matures, it gradually assumes a spherical form, and the branches are marked with red lines. When the plant is ripe it is reddish-yellow. It is quite green when young. The ripe plants break off early at the base. The flowers are inconspicuous, being small, without petals, and solitary in the axils of the leaves.

The seed is about 1/16-inch in diameter, cone-shaped, the large end concave with a well marked protuberance in the centre of the cavity.

It flowers from July to September; seeds ripen by August.

This weed propagates by seeds. It breaks off and rolls before the wind, dropping seeds in its path. Owing to its tumbling habits and its preference for dry soil, it is very prevalent in the drier portions of southern Alberta. It is doubtful if it will ever become a menace on the dark soils of our park and forest areas. On account of its rank growth, it causes serious loss by using up moisture that is required for the development of the grain.

Green young Russian thistle may be cut and cured for hay. It makes a fairly nutritious feed for live stock.

### CONTROL METHODS.

Sow clean seed.

Hand-pull stray plants.

Harrow the growing crop; it is easily killed when young by this method.

In cases where spring grain is seeded on land badly infested with weeds, the land should be worked early in the spring, and at intervals until warm weather is assured; then seed immediately after last cultivation.

Russian thistle grows rapidly after the crop is cut, and soon matures. A good plan, therefore, to check the growth, is to cultivate immediately after the binder; then plough as soon as possible after the crop is removed.

Summer fallow is strongly recommended on those areas where the weeds are plentiful. In the drier portions of this Province, summer fallow every other year is practised with good results.

Fence lines, road allowances and other waste places should be kept free from this weed. They are breeding grounds which serve to infest the adjoining fields.



## Stinkweed

(*Thlaspi arvense*, L.)

---

Stinkweed is an annual and winter annual of European origin. The plant grows from 6 inches to 2 feet high. The plant is erect, with numerous branches arising from the upper part. When young it is a dark green colour, changing to a golden yellow, or whitish at maturity. It has a disagreeable and characteristic odour. One plant will produce from 1,600 to 15,000 seeds.

It is found in most districts in Alberta, occurring particularly in the older settled parts. It is brought in with feed, seed, hay, machinery, wind, live stock, and settlers' effects. It flowers from April to late in the fall.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.



STINKWEED  
(*Thlaspi arvense*, L.)











BLUE BUR OR STICKSEED  
(*Lappula echinata*, Gilbert)

## Blue Bur or Stickseed

(*Lappula echinata*, Gilbert)

---

Blue bur, introduced from Europe, is an annual and winter annual, growing erect, and branches, and the whole plant is covered with short white hairs. Both the stem and root leaves are linear-oblong; root leaves are about 3 inches long, narrow at the base; stem leaves are stalkless. The flowers are small, about  $\frac{1}{8}$ -inch across, pale blue in colour, erect, arranged in long, somewhat one-sided clusters.

In areas of the Province where stubbling-in is practised to any great extent, this weed has become a serious pest. It has a peculiar odour; stock refuse to eat it. The bur of this weed is very troublesome to sheep, on account of the fleece becoming matted with it.

It flowers from June to August; seeds ripen July to September.

The seed is about  $\frac{1}{8}$ -inch long, dark brown, pear-shaped, with a rough surface; margin covered with hooked spines.

This plant propagates by seeds.

It occurs along road-sides, in waste places, in corrals, and around buildings, as well as in stubble fields that should be summer fallowed.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.



## Redroot

(*Amaranthus retroflexus*, L.)

---

Redroot is an annual. It is an erect growing plant, usually much branched; leaves are ovate in shape and borne on long stalks, each leaf tipped with a bristle. The stems are covered with coarse hairs. The entire plant is light green in colour. The long tap-root, however, is a pale pink, hence the name of the weed, "Redroot". Its flowers are green, borne on compound spikes at the axils of the leaves and at the end of the branches. The individual flowers are quite inconspicuous.

It occurs generally over the Province of Alberta, and in many districts is increasing with alarming rapidity. It is a gross feeder, and, when growing thickly, will greatly reduce the yields of grain.

It flowers during July and August; seeds ripen in August and September.

The seeds are almost black in colour, shiny, oval, and flattened on both sides.

### CONTROL METHODS.

Spud or hoe out stray plants. This is quite effective because when cut below the crown the plant will die.

Be careful not to sow it in clover or grass seed. It is easily cleaned out of cereal grains.

See "Control of Annual Weeds," page 6.



REDROOT  
(*Amaranthus retroflexus*, L.)











RUSSIAN PIGWEED  
(*Axyres amarantoides*, L.)

## Russian Pigweed

(*Axyres amarantoides*, L.)

Russian pigweed is an annual, introduced from Siberia. It is a tall, coarse plant, from 2 to 4 feet high, erect, widely branching and very leafy, pale green in colour. Flowers are quite small and pale yellow in colour. The plant when mature is of a light golden colour. The stems turn almost white.

The seeds are oval, flattened, 1/12-inch long, grey or brown, with a silky lustre, surface minutely lined and wrinkled lengthwise, basal scar short thin groove across the lower end.

It occurs in small patches throughout the Province, along railroads, sides of roads, feeding yards, etc. Several districts report it to be bad in their grain fields, and their hardest weed to control. It propagates by seed.

### CONTROL METHODS.

Keep road allowances, edges of fields, and waste places clean.

Pull, pile in heaps, and burn. A single plant will produce as many as 25,000 seeds.

Harrowing the crop two or three times, after it is up 3 inches, will destroy many plants.

Seed down for 4 or 5 years with a permanent grass mixture. The weeds should be kept cut until the grass has taken complete possession of the soil.

Fall cultivation right after harvest will start many seeds which will be destroyed by the frost.

Badly infested fields should be spring cultivated early and then thoroughly summer fallowed, and the succeeding crop harrowed several times.

Potatoes, corn, and other hoed or cultivated crops, if kept clean, will do much to rid the soil of the pest.

Sow clean seed. Hand-pull stray plants.

Clean up after the threshing machine. Screenings containing seeds of this plant should be fanned to take the seeds out, which should be burned. There is little feed value in Russian pigweed seeds, and very few at any time should be fed.

The threshing machine and bundle racks should be thoroughly cleaned out and swept off before moving.

Promote a dense, uniform crop growth by heavier, shallow seeding, and the use of good seed, fertilizer, and a well prepared seed bed.





LAMB'S QUARTERS

*(Chenopodium album, L.)*

## Lamb's Quarters

(*Chenopodium album*, L.)

---

Lamb's quarters is an annual European plant commonly known as pigweed. It grows from 1 to 4 feet high, with erect, slender stems, which are grooved and branched. The leaves are pale green in colour, coarsely toothed, narrow at the base, and borne on long, slender stocks. Flowers are greenish in colour, and arranged in compound spikes borne in the axils of the leaves. Individual flowers are inconspicuous.

It is a weed that should receive attention. It is a gross feeder, and is a pest, especially in gardens and garden crops, and in the yards around buildings. It is also a harbour for insects and fungus diseases. It frequently is very bad in grain-fields.

It flowers from June to September; seeds ripen from August to November.

The seed is about 1/20-inch in diameter, round, and flattened on one side, and is shiny black in colour. It is often found enveloped in a brown or greyish covering.

It is general throughout the Province.

### CONTROL METHODS.

Hand-pull stray plants, or cut before they go to seed.

A well worked summer fallow every two or 3 years usually keeps the land fairly free from a serious infestation of this weed.

Harrow the growing crop after it is up 2 or 3 inches. Repeat the harrowing 2 or 3 times, until the grain is 6 inches high.

Sow clean seed. The seed of lamb's quarters is a very common impurity in both grass and cereal seed. Care should be taken not to plant seed with the seeds of lamb's quarters.

Sheep help greatly to control it.





WILD BUCKWHEAT  
(*Polygonum convolvulus*, L.)

## Wild Buckwheat

(*Polygonum convolvulus*, L.)

---

Wild buckwheat is an annual, of European origin. It is a twining vine with branching stems, and arrow-head shaped leaves. The flowers are greenish-white in colour, and are borne in clusters in the axils of the leaves.

The seeds are a dull brownish-black colour, and are triangular in form, Sometimes the hull drops off, exposing the white kernel.

It is quite commonly found in grain-fields throughout the Province. Frequently we find it causing quite a considerable loss in yield.

The seeds are difficult to separate from grain—an indent type of seed cleaner possibly effects the most satisfactory separation.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.





SMALL WALLFLOWER  
(*Erysimum parviflorum*, Nutt.)

## Small Wallflower

(*Erysimum parviflorum*, Nutt.)

---

Small wallflower is a native biennial, growing from 6 inches to 2 feet high, stems erect, simple or branching; whole plant hoary, with short, stiff bristles. In colour it resembles a prairie sage. The flowers are bright yellow, about  $\frac{1}{4}$ -inch in diameter.

The seed-pods are borne on short stems, and look somewhat like those of worm-seed mustard. This plant is sometimes mistaken for worm-seed mustard.

It flowers from July to August; the seeds ripen from August to September.

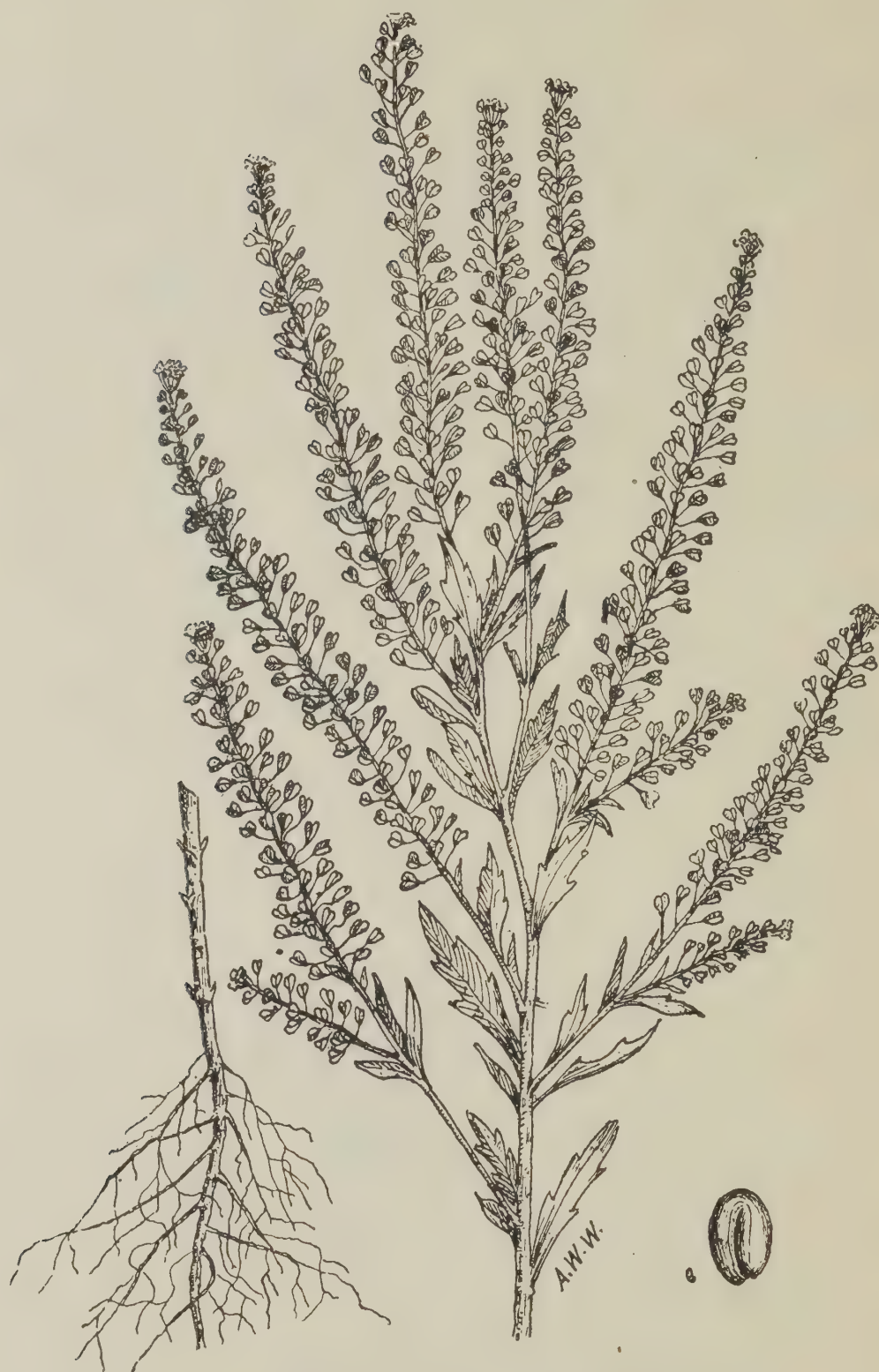
The seed is irregular in shape, and reddish-brown in colour.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.

N.B.—Generally speaking, the methods adopted for the control of mustards will control this weed, which is becoming more prevalent in many districts of this Province.





WILD PEPPER GRASS  
(*Lepidium apetalum*, Willd.)

## Wild Pepper Grass

(*Lepidium apetalum*, Willd.)

Wild pepper grass is an annual and a winter annual. It grows from 6 inches to 2 feet high. The stem usually has many branches. The lower leaves terminate in a large lobe with small lateral ones, and with edges lightly cut in along the margin. The upper leaves are tapering. The plant is greyish in colour, and is covered with short hairs. The young plant, which starts in the fall, appears as a rosette of dark green leaves. As the plant matures, these leaves drop off. The flowers are small and white, with slender, spreading flower stocks.

The seed-pods are small, about 1/10-inch wide, heart shaped, notched at the top, and, at maturity, separate into halves.

This plant is becoming more troublesome from year to year throughout the grain fields of Alberta. It has a bad effect as an impurity upon the sale of timothy and clover grown for seed.

It flowers in June and July; the seeds ripen early in July and during August.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.





YELLOW WHITLOW GRASS  
(*Draba nemorosa*, L.)

## Yellow Whitlow Grass

(*Draba nemorosa*, L.)

---

This is a native annual and winter annual, growing from 6 to 12 inches high. The whole plant is slightly downy, and branches below. The leaves are stockless, lance-shaped, slightly toothed. Flowers are of a whitish yellow colour. The pods are elliptical-oblong, half the length of the foot stalks, which are almost horizontal at maturity.

This weed is becoming troublesome in only a few places in the Province, and on quite small areas. It, however, should be kept in check.

It flowers in June and July; the seeds ripen in July and August.

The seed is small, 1/16-inch long, egg-shaped, flattened, and reddish-brown in colour.

It occurs mainly in stubble fields more or less throughout the Province.

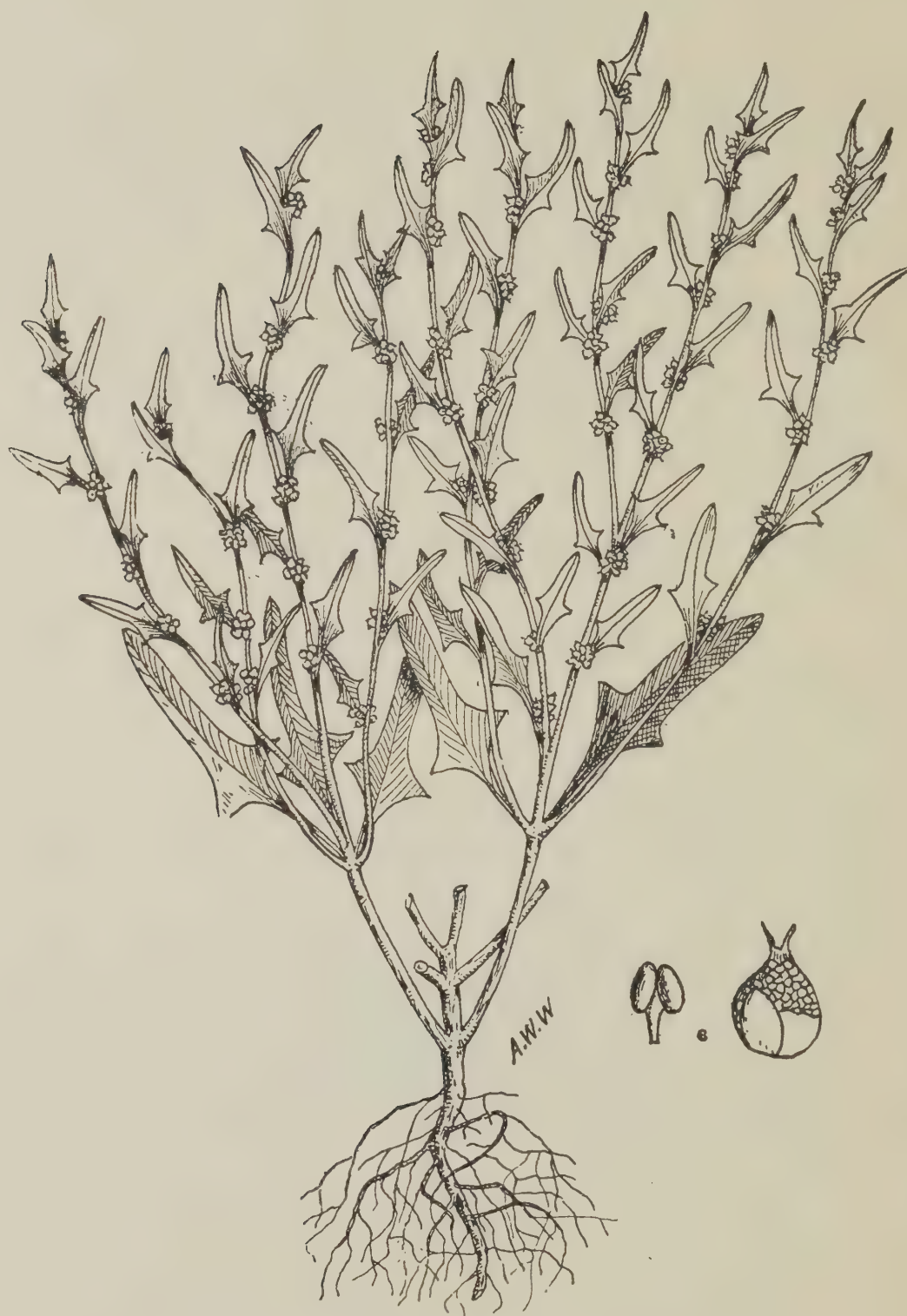
### CONTROL METHODS.

Cultivate with a disc, or plough very shallow, as soon as possible after the binder.

In cases of badly infested areas, delay seeding in the spring to allow as many seeds as possible to germinate and produce plants which should be cultivated off prior to seeding.

Plough the summer fallow early, so that the plant will be destroyed before going to seed. Cultivate at frequent intervals throughout the summer fallow period. On land that drifts when worked to any great extent during the summer fallow year, sheep put on the summer fallow will keep this weed well under control; they also will keep it down on waste places.





SPEAR LEAF GOOSEFOOT  
(*Monolepsis chenopodioides*, Moq.)

## Spear Leaf Goosefoot

(*Monolepsis chenopodioides*, Moq.)

---

This is a native annual, with low, spreading habits of growth. The whole plant is dark green in colour, resembling lamb's quarters to some extent. The leaves are spear-shaped and fleshy. The flowers are borne in the axils of the leaves, and are quite inconspicuous.

It occurs throughout the Province, along roadsides, in waste places, and in gardens. It also appears in stubble fields that need cleaning up by summer fallow or other means.

### CONTROL METHODS.

Cut with a hoe before the plants go to seed.

When found in grain-fields, the usual method advised for the destruction of annuals will hold it in check.



## Shepherd's Purse

(*Capsella bursa-pastoris*, L.)

---

Introduced from Europe, shepherd's purse is an annual and winter annual. The root leaves form a large rosette which lies close to the ground, and in this stage lives through the winter. It may produce a single stalk from 1 to 6 inches high, then producing its seed, or it may send up several branches 1 foot to 3 feet high. It may be bright green and nearly smooth, or grey from very short compressed hairs. The leaves may be deeply cut, pinatifid, or without any teeth or divisions. The stem leaves are for the most part arrow-shaped with two sharp, ear-like projections, one on each side of the stem. The flowers are small and white. The only part of the plant which seems to be constant is the seed pod, which is flat, triangular in shape,  $\frac{1}{4}$ -inch long, wedge-shaped at the base, notched at the top, with the outer angles rounded. Each pod contains about 20 seeds. An average plant produces over 50,000 seeds.

The seed is small,  $\frac{1}{24}$ -inch long, oblong, reddish-brown, the surface dull and punctured. It develops a large amount of mucilage and a covering of rather long but very fine transparent hairs.

It flowers throughout the season. The plant grows and ripens seeds except in freezing weather.

It propagates by seed.

It occurs throughout Alberta in all kinds of soil. Very common in gardens and around buildings. There are districts in the Province where it is considered a very serious weed, choking out crops, and being very hard to get out of the soil.

### CONTROL METHODS.

See "Control of Annual Weeds," page 6.



SHEPHERD'S PURSE  
(*Capsella bursa-pastoris*, L.)





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## NOTICE

Those wishing information on weeds not specifically dealt with in this Bulletin should communicate with:

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